2008-02-26

To whom it may concern,

Letter of Agency

I, an officer of SHENZHEN MTC CO., LTD do hereby authorize Intertek Testing Services (Mr. Shawn Xing) to act on our behalf in front of the Federal Communications Commission with respect to all matters relating to certification of equipment under Part 15 and/or Part 95 of the FCC Rules until further notice.

I further certify that no party (as defined in §1.2002(b) of CFR 47, 2004) to this application, including myself, is subject to a denial of federal benefits, that includes FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C., 862.

Regards,

Jian Kang

Technical Director

This Equipment Under Test (EUT) is a ATSC Set Top Box, it used to receive the digital TV signal (ATSC) and demodulate to Audio / Video signal out put via the RF tuner. This EUT is powered by 120V/AC. Besides , it can also modulated the ATSC signal to TV receiver via RF output terminal which is designed to convert the Audio / Video signal to standard NTSC CH3 or CH4 RF signal. There are two different channels available, Channel 3 and Channel 4, it can be selected by the switch on the back panel. A coaxial cable (75 ohm, 0.8m) is provided with this device. Power and channel-select buttons are located on the front panel, most of the input or output terminals are located at the back panel including a smart antenna terminal that can be connected to a terrestrial antenna, the EUT can control the terrestrial antenna gain and direction automatically to optimize the receiving signal via the smart antenna terminal.

When the EUT is switched on, the software stored in the flash U8 (2 M-byte) and the memory U2 (16 x 16M DDR) is active, controls the MCU U1 (ZR39741) to search the ATSC TV signal via RF tuner, the RF tuner demodulates the RF signal to IF signal and transmit to the MCU U1, the MCU U1 demodulates the IF signal to audio / video signal and outputs via the A / V output terminal after the IC2 (CE2752, audio decoder) and U7 (4558, audio filter and amplifier), and U6 (FMS6143, video filter and amplifier). Also, the MCU U1 transmits the audio / video signal to the RF tuner, the RF tuner modulates the A / V signal to NTSC RF signal and output via the RF output terminal.

IC Function：
U1 (ZR39741) MCU, Program search, demodulation and decode
U2 （Memory） Software store
U8 （FLASH） Software store
IC1 （AF1071）Reset IC
IC2 (CE2752) Audio Decode IC
U6（FMS6143）CVBS active filter and amplifier
U7（4558）Audio active filter and amplifier
U13（AP1530）DC converter, convert 5V to 1.8V
U15(AP1513) DC converter, convert 5V to 3.3V
U10(TNY277) MCU of the built-in SMPS
D14, transformer, transfer 3.3V to 2.6V

The RF Tuner specification is attached as the following pages.

SBU Technology - Tuners

DTT 7685x

ATSC half NIM with ch 3 / 4 modulator

Specification

20 Apr 2007

Features

- Receives digital off-air and cable signal
- Receiving frequency 55.25MHz to 864.25MHz
- Built-in 5-33V DC-DC converter (optional)
- Single power supply to the tuner, IF VGA & modulator section
- Wide Band AGC (bus control switch-able) to optimum strong signal performance
- Read RF AGC information via I2C Bus
- Tuner power standby mode via I2C Bus
- Modulator Video / Sound inputs and Ch3 / 4 RF output
- Available in both vertical and horizontal mount versions
- Meet A-74 requirement
- RoHS compliance

MODEL	DESCRIPTION	PRODUCT REF. NO.
DTT 76850	ATSC half NIM with Ch 3 /4 modulator, Horizontal mount LH	21682310
DTT 76851	ATSC half NIM with Ch 3 /4 modulator, Vertical mount	21686000

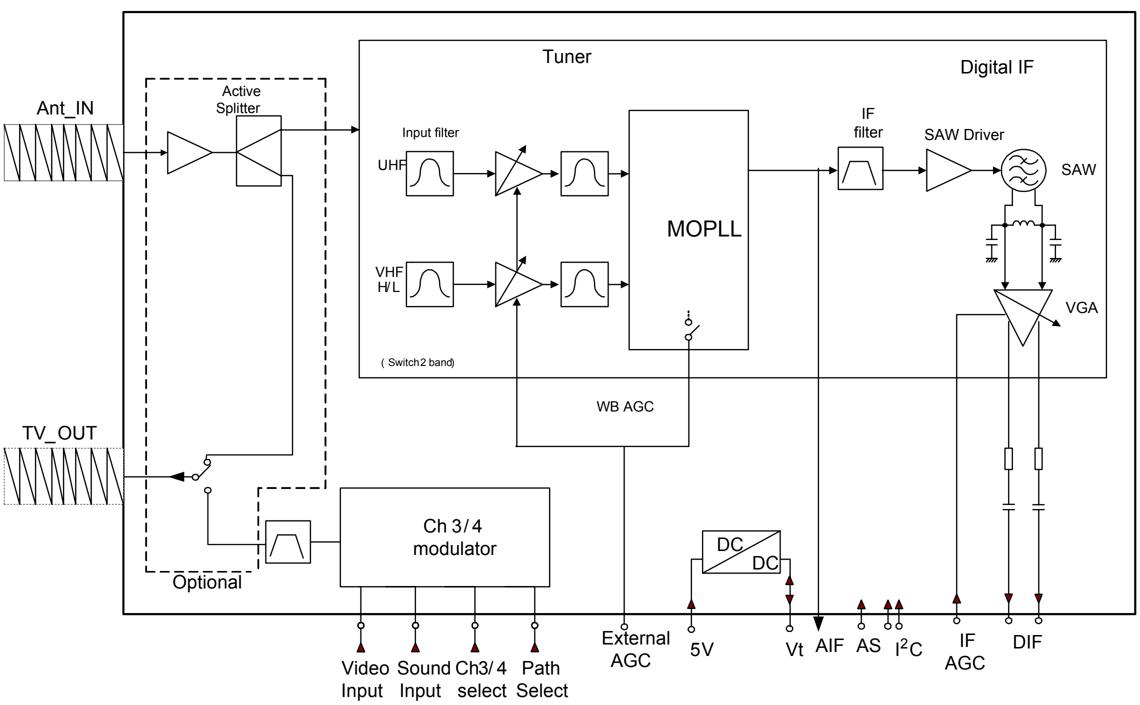
Table of content

1. Brief description

DTT 7685x is a newly developed ATSC half NIM with ch 3 / 4 modulator to be used in ATSC digital (VSB & QAM), it consists of:

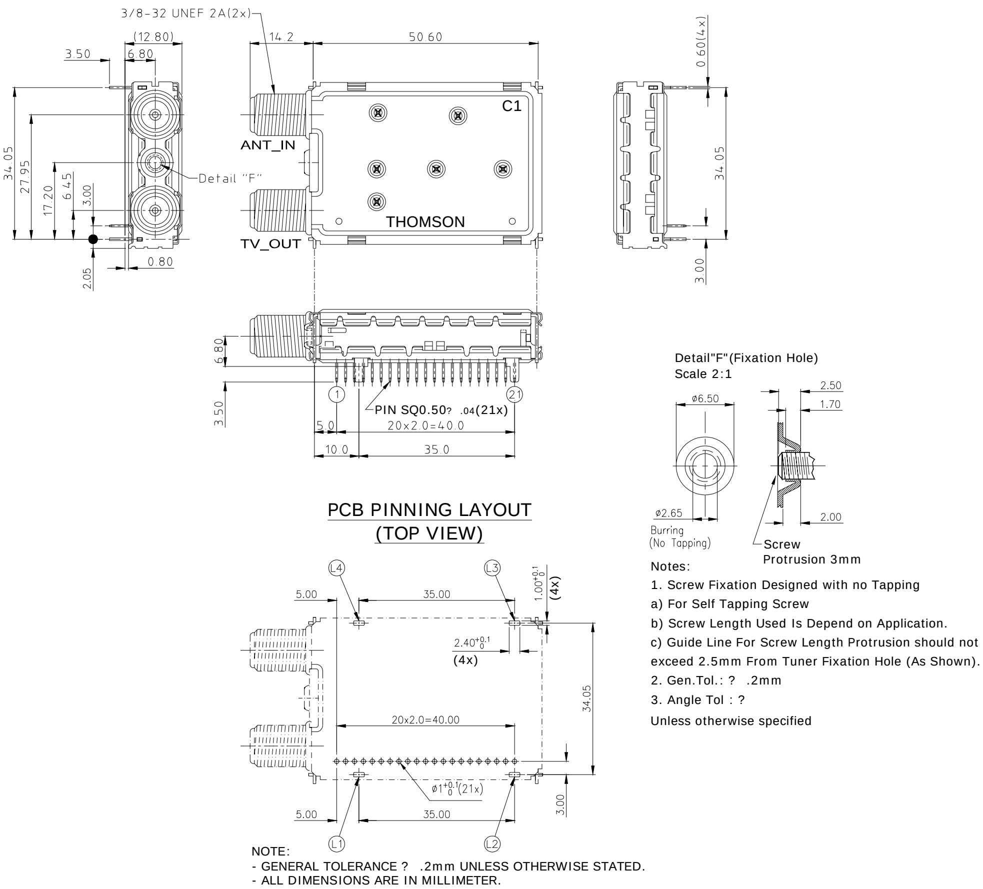
a. A switch 2 bands RF tuner, which receives NTSC / ATSC signal & down-converts it to an IF frequency of 44MHz for digital and 45.75MHz for analog IF.
b. A digital IF Stage, which consists of one SAW filters & gain controllable IF amplifiers and outputs a 1.0Vp-p IF signal with a good IF selectivity.
c. An analog modulator which modulates base-band video and sound to RF channel 3 or 4.
d. An active splitter (optional), which is designed with 50 /50 split, with good signal handling & also provide sufficient gain compensation for the splitting loss & with right return loss for cable reception
e. RF switch at TV_OUT (optional) provides good isolation from Ant_IN to TV_OUT at ch 3 / 4.

2. Block diagram



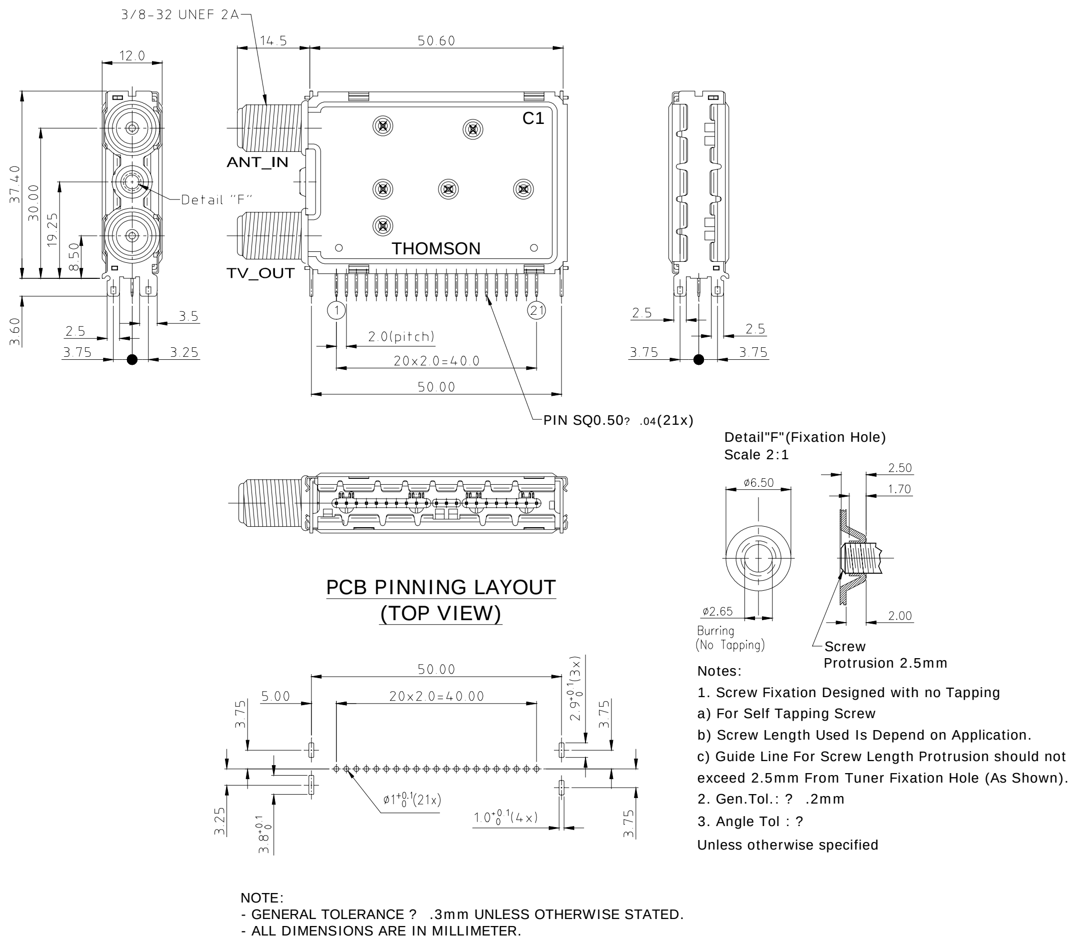
3. Mechanical Specification

3.1 Horizontal Mounting LH (DTT 76850)



Note: please refer to the application section 12.7 for lug L1~L4 proper connection.

3.2 Vertical Mounting (DTT 76851)



4. Pin Definitions

Pins No	Pins Name	Pins Description :
1	--	--
2	Vcc1	Supply for Tuner +5V
3	Path Sel	*Select modulator carrier On /Off (Optional)
4	Ch3/4	Select RF frequency CH3 / CH4
5	RF AGC	External RF AGC input
6	Audio in	Base band sound input
7	Video in	Base band video input
8	Vcc2	Modulator supply +5V
9	--	--
10	--	--
11	--	--
12	GND	Ground
13	--	--
14	SCL	I^2C clock
15	SDA	I^2C data
16	As	Tuner address select
17	IF out	IF output
18	IF AGC	IF amplifier AGC control 0…3.3 V
19	GND	Ground
20	D-IF out	Digital IF output balanced
21	D-IF out	Digital IF output balanced

Note: 1. both “—“no connection & “int” in the application should leave it open

*2. Path sel (Mode On/Off select) is also controlled by I^2C. Please refer to 3rd table on page 13 for details.

5. Operational Conditions

No	Parameter	Unit	Min	Typ	Max	Remarks
1.	Ambient temperature	°C	0	25	60	
2.	Relative humidity	%	-	-	90	
3.	+5.0 V supply	V	4.75	5	5.25	Ripple ≤ 10mVpp
4.	+5.0 V current @ pin2	mA		190		
5.	+5.0 V current @ pin8	mA		50		

6. Standard Test Conditions

No	Parameter	Unit	Min	Typ.	Max	Remarks
1.	Ambient temperature	°C	23	25	27	
2.	Relative humidity	%	45	60	75	
3.	+5Vdc supply	V	4.9	5.0	5.1	
4.	Input Impedance	Ω	-	75	-	
5.	Nominal Input level	dBuV	-	60	-	(1.0mV) into 75Ω
6.	Nominal Video I/P	Vp-p		1		@75Ω loaded
7.	Nominal Sound I/P	Vp-p		1		@600Ω loaded

Note: A proper function is guaranteed within the specified supply voltage and environmental conditions but a certain deterioration of performance parameters may occur at the limits of operational conditions.

7. Electrical Characteristics

7.1 RF Section

No	Parameters		Unit	Min	Typ	Max	Remarks
1.	Frequency Range	Analog Band - 1 Band - 2 Band - 3 Digital Band - 1 Band - 2 Band – 3	MHz	 55.25 151.25 421.25 -- 57.00 153.00 423.00	-	 145.25 415.25 859.25 -- 147.00 417.00 863.00	
2.	IF Frequency	Center Picture Chroma Sound	MHz		44 45.75 42.17 41.25		
3.	Frequency Margin		MHz	3			
4.	Tracking	PC-CC Tilt PC-SC Tilt	dB	-3		+3 +5	
5.	V.S.W.R.		-		2	6	
6.	Noise Figure	Air Channels Cable channels	dB		6 6	8 10	
7.	Voltage Gain	@ pin 17	dB		39		
8.	AGC Range	B1 B2 B3	dB	50 45 40	70 58 58		
9.	1% Cross Modulation	(N±1) (N±2)	dBuV		69 74		Unwanted: 80% AM. S/I=46dB @ 75Ω load open.
10.	CB Rejection	0.5 - 30MHz 30 - 41MHz	dBuV	101 81			
11.	IF Rejection		dB	60	88		
12.	Beat Rejection	CH06 CH05	dB	50 55	55 60		
13.	FM Beat Susceptibility	88.1 – 92MHz 92.1 - 107.9MHz	dBuV	59 69	63 73		
14.	FM Rejection on CH06	88.1 - 90.1MHz 90.1 - 107.9MHz	dB	2 5			
15.	Half-IF Susceptibility	Air Channels Cable Channels	dB	25 18	35 25		
16	Adjacent Channel Rejection		dB	55	60		
17.	Image Rejection	CH06 CH14-CH55 All other channel	dB	70 60 50	74 70 68		
18.	LO Phase Noise	1kHz 10kHz 100kHz	dBc/Hz	-52 -85 -106	-62 -90 -112		
19.	Oscillator Stability	at 25°C ± 15°C	ppm			30	4MHz crystal ref.

No	Parameters		Unit	Min	Typ	Max	Remarks
20.	LO Voltage at the Antenna	5 -- 54MHz 54 -- 864MHz 864 -- 1810MHz	dBuV			10 33 51	
21.	Tuning Response Time		ms		30	100	
22.	Differential D-IF out	Pin 20 & 21	Vp-p		1.0		
23.	IF AGC Voltage		V	0.5		3.3	
24.	IF AGC Range		dB	43	48		
25.	LO Level at IF Output		dBuV			88	
26.	Overall Tuner Gain		dB	72	80		See Appendix 12.5 For testing condition

7.2 Ch 3/ 4 modulator performance

No	Parameters	Unit	Min	Typ.	Max	Remarks
1.	Video carrier frequency accuracy	KHz	-25		25	
2.	Video carrier output level	dBuV	70	73		No signal
3.	Video carrier frequency stability	KHz	-25		25	Ta = 25°C ±10
4.	Audio carrier output ratio	dB	13.0	15.5	18.0	
5.	Audio 2nd harmonic distortion	dB	50	65		fpc+2x4.5MHz
6.	Audio 3rd harmonic distortion	dB	45	55		fpc+3x4.5MHz
7.	Video harmonic distortion	dB	45	72		
8.	Video modulation depth	%	75	80	85	10 step grey scale @1Vp-p input,75Ω loaded
9.	Video S/N	dB		50		Un-weighted @1Vp-p input, 50% white
10.	Video frequency response	dB	-1.1		0.3	0.75 ~3.75MHz
11.	Differential gain	%	-5		5	
12.	Differential phase	°C	-5		5	
13.	Audio modulation depth	%	90	100	110	Sound I/P = 1KHz @ 1vp-p, 100% equals to 25kHz dev
14.	Audio distortion	%		1	2	Sound I/P = 1KHz;
15.	Audio S/N	dB	45	50		Sound I/P = 1KHz; Video Color bar

8. Application Information

8.1 Tuner I2C control

Write Data format: (MSB is transmitted first)

Name	Byte	B7	B6	B5	B4	B3	B2	B1	B0	Ack
Address Byte 1	**AB1**	1	1	0	0	0	MA1	MA0	0	A
Prog. Divider Byte 2	**DB2**	0	N14	N13	N12	N11	N10	N9	N8	A
Prog. Divider Byte 3	**DB3**	N7	N6	N5	N4	N3	N2	N1	N0	A
Control Data Byte 4	**CD4**	1	C1	C0	R4	R3	R2	R1	R0	A
Control Data Byte 5	**CD5**	BS1	BS0	SL1	SL0	P3	P2	P1	P0	A
Control Data Byte 6	**CD6**	X	0	ATC	IFE	X	AT2	AT1	AT0	A
Control Data Byte 7	**CD7**	SAS	X	AGD	ADS	T3	T2	T1	T0	A

Following is the detail breakdown of each byte:

a) MA1, MA2 : address bits
b) N14- N0 : programmable division ratio bits
c) R4 - R0 : reference divider ratio select
d) C1, C0 : charge pump current select
e) BS1 – BS0 : band select bits
f) SL1 – SL0 : Power down modes
g) SAS : Saw filter drive output select
h) P3 – P0 : Port P3 – P0 output states
i) ADS : ADC input select
j) ATC : AGC decay current
k) AGD : AGC disable
l) AT2:AT0 : AGC setting
m) T3 – T0 : test mode
n) IFE : IF AGC amplifier enables
o) POR : power ON reset indicator
p) FL : phase lock flag
q) AGF : AGC active flag
r) V2:V0 : ADC out
s) X : don't care

Read Data format: (MSB is transmitted first)

Name	Byte	B7	B6	B5	B4	B3	B2	B1	B0	Ack
Address Byte 1	**AB1**	1	1	0	0	0	MA1	MA0	1	A
Status Byte	**SB2**	POR	FL	0	0	AGF	V2	V1	V0	A

Tuner Address (AB1):

Tuner Address (Hex)	MA1	MA0	Voltage at Pin16 AS
C0	0	0	(0 to 0.1) *Vcc
C2	0	1	Open Circuit
C4	1	0	(0.4 to 0.6) *Vcc
C6	1	1	(0.9 to 1) *Vcc

Programmable Divider Byte 2 & 3 (DB2 and DB3)

Divider Ratio (N14 to N0):
N = Fosc (MHz)/62.5 kHz
N =16384*N14 + 8192*N13 + 4096*N12 + 2048*N11 + 1024*N10 + 512*N9 + 256*N8 + 128*N7 + 64*N6 + 32*N5 + 16* N4 + 8*N3 + 4*N2 + 2*N1 + N0

Control Data Byte (CD4):

Charge Pump Current select:

C1	C0	Typ. current in (uA)
0	0	155
0	1	330
1	0	690
1	1	1450

Default state in power up: 00

Control Data byte (CD7):

Test Mode (T3, T2, T1 & T0)

Mode	T3	T2	T1	T0
Normal Operation	0	0	0	0
AGC sink Iagc= -100uA	0	0	1	0
AGC source Iagc= 10uA, P0=output of AGC bias DAC	0	0	1	1

Default state in power up: 0000

Power mode select (CD5):

SL1	SL0	Power mode	Section status				Power (mA) (excluding IFamp)
			IIC interface & registers	Crystal oscillator	PLL & VCO	Converter & IF stages	
0	X	Sleep	Enabled	Enabled	Disabled	Disabled	9
1	0	PLL & VCO	Enabled	Enabled	Enabled	Disabled	42
1	1	Full function	Enabled	Enabled	Enabled	Enabled	***Full***

Default state in power up: 01

Control Data byte (CD4):

Reference Divider Ratio

R4	R3	R2	R1	R0	Ratio	Fref (kHz)
0	0	0	1	1	16	250
0	0	1	0	0	32	125
0	0	1	0	1	64	62.5
0	0	1	1	0	128	31.25
0	1	0	1	1	20	200
0	1	1	0	0	40	100
0	1	1	0	1	80	50
0	1	1	1	0	160	25
1	0	0	1	1	24	166
1	0	1	0	0	48	83.33
1	0	1	0	1	96	41.67
1	0	1	1	0	192	20.83
1	1	0	1	1	28	142.8
1	1	1	0	0	56	71.42
1	1	1	0	1	112	35.71
1	1	1	1	0	224	17.85

Default state in power up: 10011

Tuner Band Switch Byte (CD5)

	Modulator path off (P1=0)	Modulator path on (P1=1)
Band	**CD5 (Hex)**	**CD5 (Hex)**
Band VHF-L (1)	39	3B
Band VHF-H (2)	7C	7E
Band UHF (3)	B5	B7
Band VHF-L (1) with FM trap enabled	38	3A

IF AGC amplifier Enable (CD6)

IFE	IF AGC Amplifier Function
0	Power down
1	Normal operation

Saw Drive output select (CD7)

SAS	SAWF output Drive
0	Analogue output enabled
1	Digital output enabled

AGC setting control bits (CD6)

Wideband AGC Take Over Point setting (AT2, AT1, AT0)

IF Output Level @pin17 (dBuV@75Ω)	AT2	AT1	AT0
105	0	0	0
103	0	0	1
101	0	1	0
99	0	1	1
97	1	0	0
94	1	0	1
91	1	1	0
87	1	1	1

Default state in power up: 000

a) Recommend wideband AGC TOP setting "0 1 1" for digital reception
b) Recommend external conventional AGC for analog reception

AGC Function (CD7)

AGD	Remarks
0	AGC enabled
1	AGC disabled

Wideband AGC Time Constant ATC (CD6)

ATC	Remarks
0	IAGC = 10uA; (Time constant ≈ 100mS)
1	IAGC = 0.3uA; (Time constant ≈ 3S)

ADC input select (CD7)

ADS	Status
0	AGC detector output
1	Disabled

ADC Output

Input Level (V)	V2	V1	V0
Less 0.28Vcc	0	0	0
0.34Vcc to 0.44Vcc	0	0	1
0.5Vcc to 0.6Vcc	0	1	0
0.66Vcc to 0.76Vcc	0	1	1
More 0.8Vcc	1	0	0

Read Status Byte (SB2)

Bit	Description
POR (Bit0)	The power-on reset indicator. This is set to logic “1” if the Vcc supply to the device has dropped below 3V (at 25°C).
FL (Bit1)	The PLL lock flag. It indicates whether the device is phase locked. A logic “1” is present if the devide is locked.
AGF (Bit4)	The AGC detector flag. Logic”0” means Vagc < 4V (gain reduction) Logic”1” means Vagc > 4 V (max gain)

9. Electrostatic Discharge

9.1 Test

Each front-end must be capable of normal performance following its subjection to the following tests:

MIL STD 883C HBM
Test is performed with a voltage discharge from a 100 PF capacitor over a 1500 Ω series resistance in the discharge path. There is a direct contact between the test probe head and the unit under test, using the test points and conditions detailed below:

- Test to pins 1 through LAST PIN:
  3 successive ESD discharges of 2 KVDC between each pin and the front-end frame.

IEC 1000-4-2
Test is performed with a voltage discharge from a 150 PF capacitor over a 330 Ω series resistance in the discharge path. There is a direct contact between the test probe head and the unit under test, using the test points and conditions detailed below:

- Test for antenna input socket ± **8 KVDC**

9.2 Handling

Anyone handling a front-end must wear a properly grounded anti - static discharge bracelet to minimize ESD damage.
After each front-end is aligned and tested, it will be packed with anti - static poly foam or material prior to transportation and storage. This protective foam is to remain in place until the front-end is assembled and soldered onto the receiver main board.

10. Reliability Test Procedure & Conditions

Note: Room temperature = 25 °C ± 2 °C

10.1 Heat Load Test

- Measure the DUTs at room temperature
- Load the DUTs into chamber of the following conditions:

Temperature	= 60 °C
Period	= 500 hrs
Cycle	= 1.5 hrs on; 0.5 hrs off
Quantity	= 10 pcs

- Cool-down 0.5 hr at room temperature, then measured the DUTs within 1 hr
- The test shall be continued to 1000 cycles for information only

10.2 Humidity Load Test

- Measure the DUTs at room temperature
- Load the DUTs into chamber of the following conditions:

Temperature	= 40 ± 5 °C
Period	= 24 hrs
Cycle	= constantly on
Quantity	= 20 pcs

- Cool-down 0.5 hr at room temperature, then measured the DUTs within 1 hr
- Load the DUTs again into chamber of the following conditions:

Temperature	= 40 ± 5 °C
Humidity	= 90 to 95 %
Period	= 500 hrs
Cycle	= 1.5 hrs on; 0.5 hrs off
Quantity	= 20 pcs

- Cool down 0.5 hr at room temperature, then measured the DUTs within 1 hr

10.3 Cold Test

- Measure the DUTs at room temperature
- Load the DUTs into chamber of the following conditions:

Temperature	= - 20 ± 5°C
Period	= 500 hrs
Cycle	= constantly on
Quantity	= 10 pcs

- Warm up for 2 hrs at room temperature, then measured the DUTs within 1 hr

10.4 Thermal Shock

- Measure the DUTs at room temperature
- Load the DUTs into chamber of the following conditions:

Temperature	= - 25 °C for 60 min ↓ ↑ 85 °C for 60 min
Period	= 200 cycles
Power	= power off
Quantity	= 10 pcs

- Cool-down 0.5 hr at room temperature then measured the DUTs within 1 hr

10.5 Temperature Cycle Test

- Measure the DUTs at room temperature
- Load the DUTs into chamber of the following conditions:

Temperature	= -5 °C for 16 hrs then 60 °C for 8 hrs
Period	= 500 hrs
Cycle	= constantly on
Quantity	= 10 pcs

- Cool down 0.5 hr at room temperature, then measured the DUTs within 1hr

10.6 Vibration Test

Frequency	: 3.5 Hz
Vertical amplitude	: 15 to 25 mm
Duration	: 1 hr
Quantity	: 1 carton

10.7 Drop Test

- Packaged apparatus: < or = 50 kg
- Height: < 32 … 50Kg: 0.5m
  18 … 32Kg: 0.55m
  10 … 18Kg: 0.65m
  5 … 10Kg: 0.8m
- 1 corner + 3 edges + 6 faces

  Drop on the weakest corner (point G)
  Drop on the shortest edge in contact with point G
  Drop on average edge in contact with point G
  Drop on the longest edge in contact with point G
  Drop flat wise on the side of minimum surface
  Drop flat wise on the side of opposite minimum surface
  Drop flat wise on the side of average surface
  Drop flat wise on the side of opposite average surface
  Drop flat wise on the side of maximum surface
  Drop flat wise on the side of opposite maximum surface

- Quantity: 1 carton

10.8 Life Test

- Measure the DUTs at room temperature
- Load the DUTs into chamber of the following conditions:

Temperature	= 60 °C
Period	= 500 hrs
Cycle	= constantly on
Quantity	= 20 pcs

- Cool down 0.5 hr at room temperature, then measured the DUTs within 1 hr

10.9 Reliability Test Requirement

1. Initial value measurement and after test measurement shall be done at standard conditions stated in Section 6.
2. Measurement or check shall be done at the interval of 0 hour (initial), 96H, 168H, 300H and 500H.
3. For test items 10.1, 10.2, 10.3 & 10.8, the tested units shall meet the following after duration of 96 hours, (Data compared with initial value).
   - Unit is functional:
   Frequency synthesizer is tunable on all channels for tuner as specified in section 7.1 and there is no visible defect in the received picture.
   - Tuner Performance:

	Max.
a) Change of Power Gain	3dB
b) Change of tilt (overall curve)	3dB

4. For all test items stated in this section, measurement shall be done to check whether the unit is functional (per item 3 definition) at each interval hour as specified in item 2.
5. For test item 10.4, measurement shall be done to check whether the unit is functional (per item 3 definition) at 50, 100, 150 & 200 cycles.
6. For test items 6 & 7, unit shall be functional (per item 3 definition) after test.

11. Appendix

11.1 Packaging

	INDIVIDUAL	MASTER BOX	PALLET
1. TYPE	DTT76850/51	Carton	Wood
2. QUANTITIES Tuners Cartons	 1 -	 65 1	 5200 80 boxes
3. WEIGHT (Approximate)	0.035kg	3.34kg	267.2kg
4. DIMENSIONS L × H × D (in mm)	65.5x34.5x16.3	463x393x62	1200x800x150

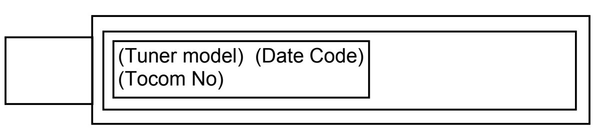
(*): not include antenna terminal

11.2 Identification / Traceability

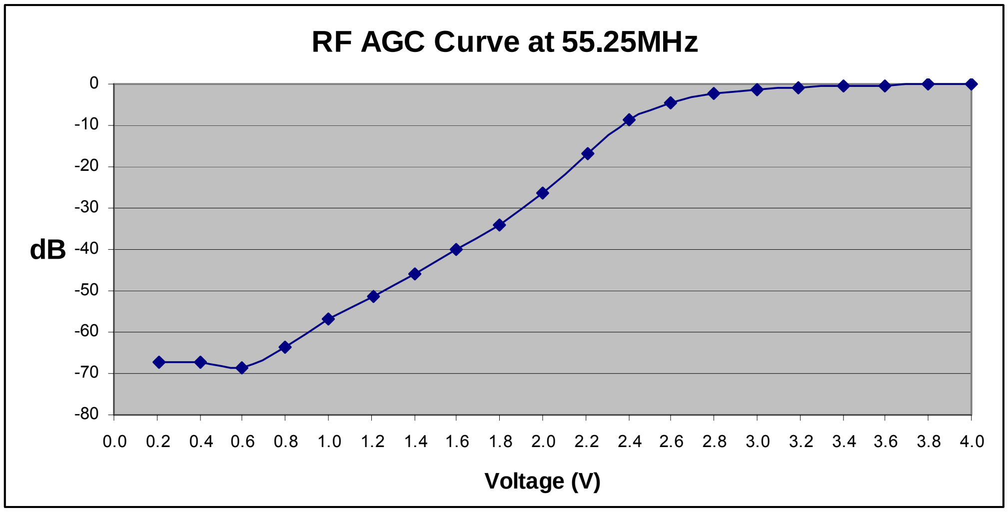
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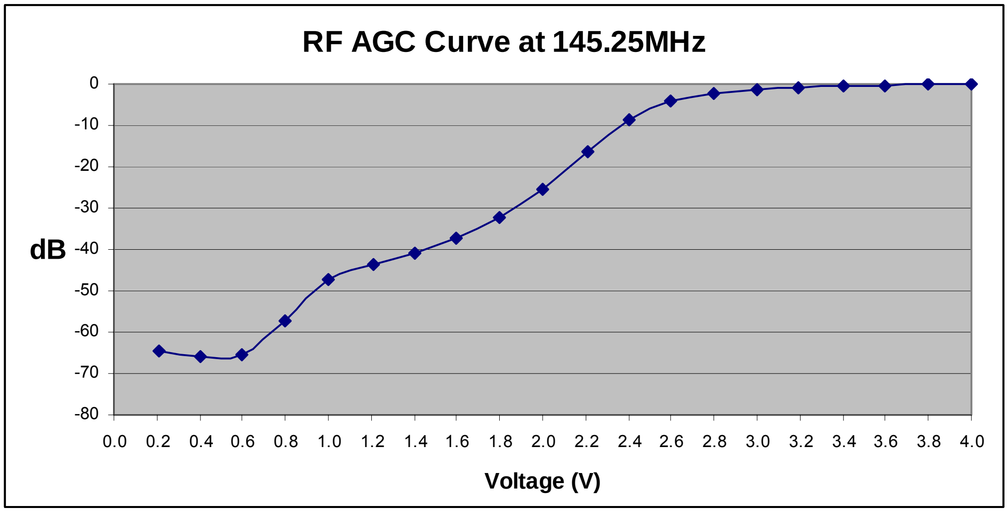
(Tuner Model)	
TOCOM NO.	**:** xxxxxxxx
QTY.	**:** xx PCS
Order NO.	**:**
Customer P/N	**:**
CTN. NO.	**:** Carton Label No.

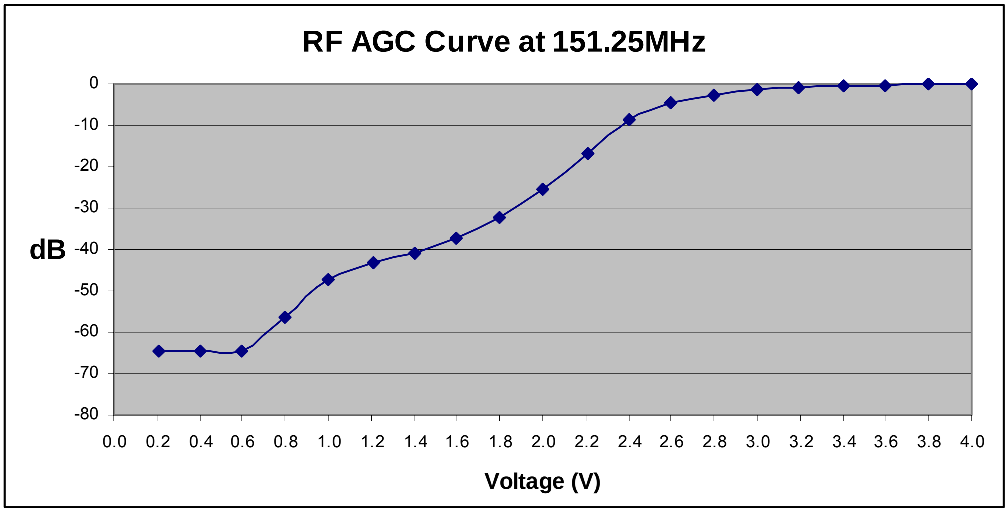
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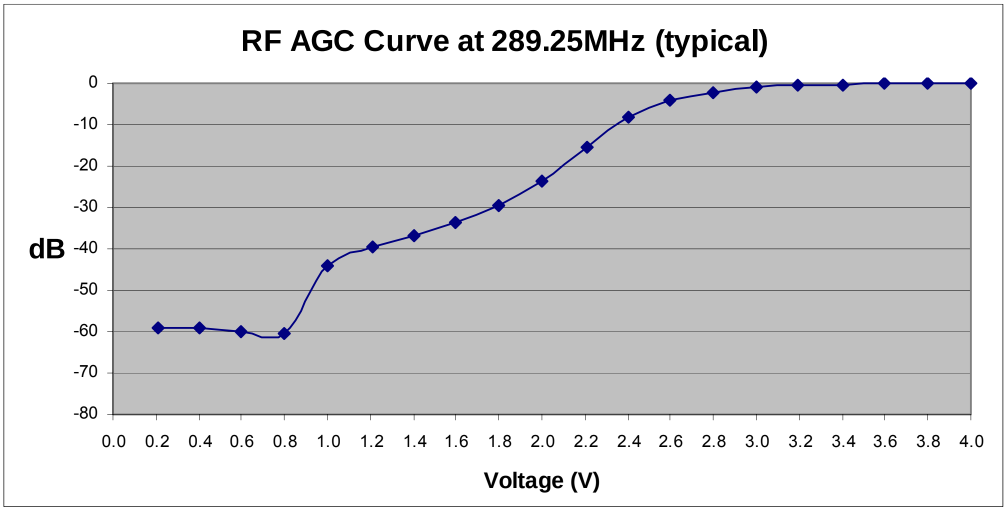


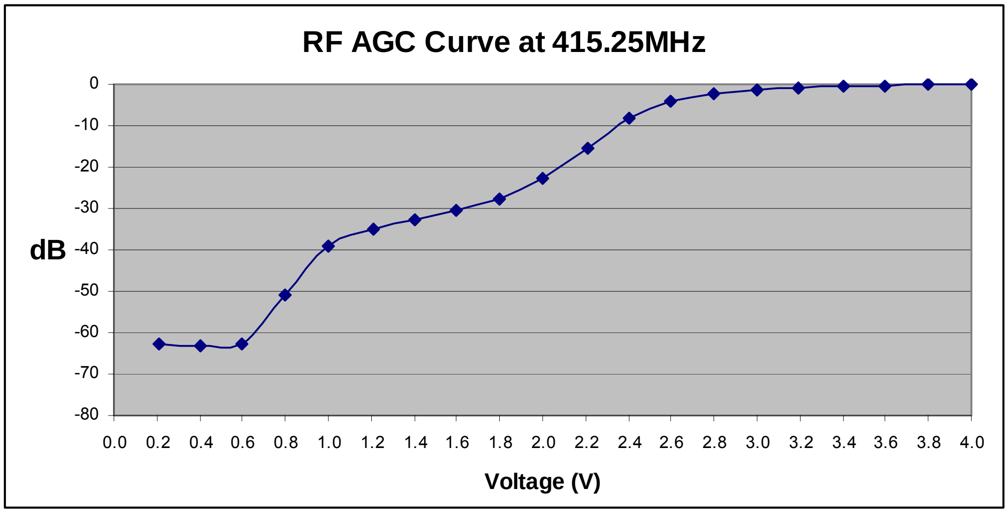
11.3 RF AGC Slope (Typical Curve)

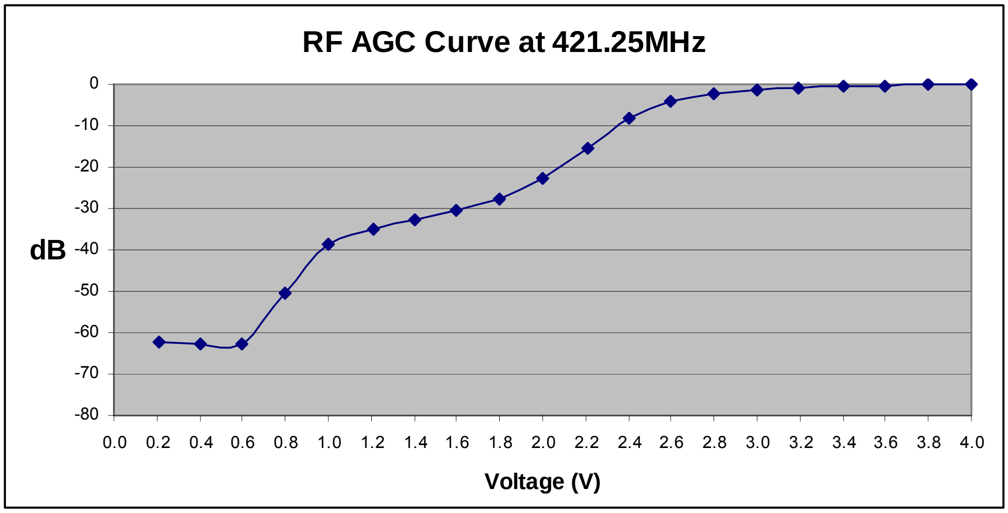


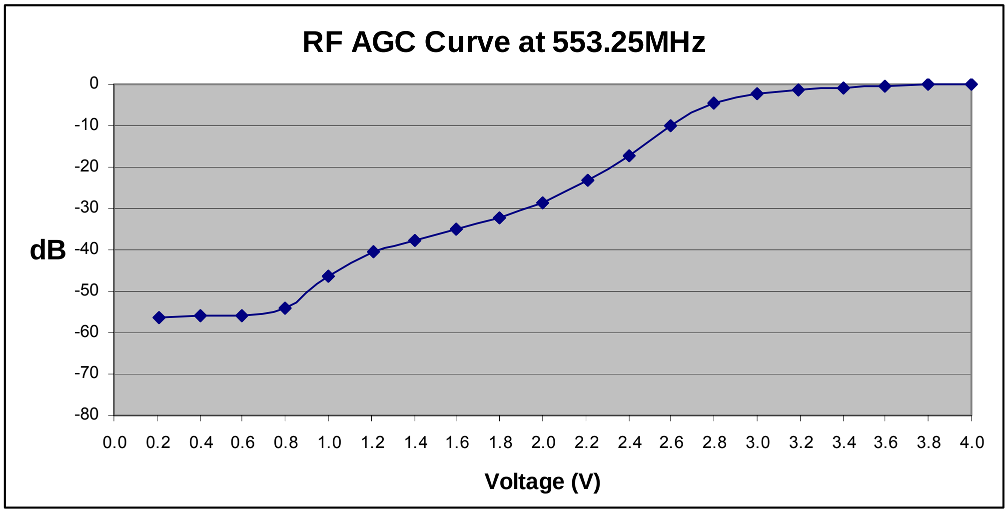


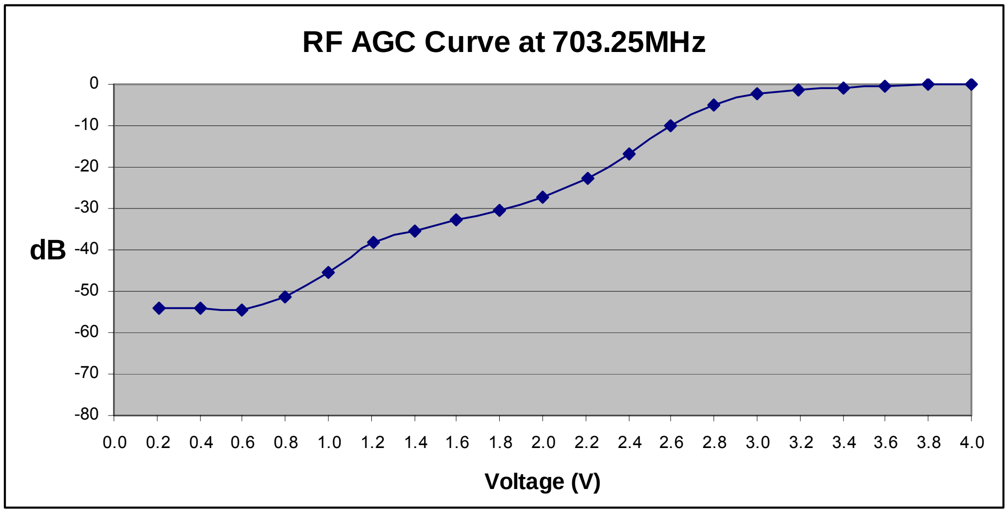


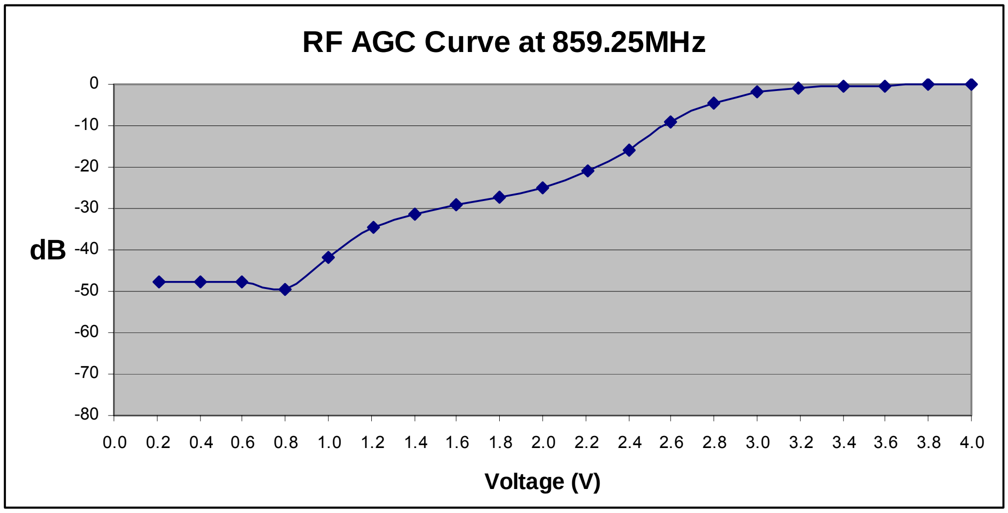

RF AGC Curve at 289.25MHz (typical)
dB
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0
Voltage (V)


RF AGC Curve at 415.25MHz
dB
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0
Voltage (V)

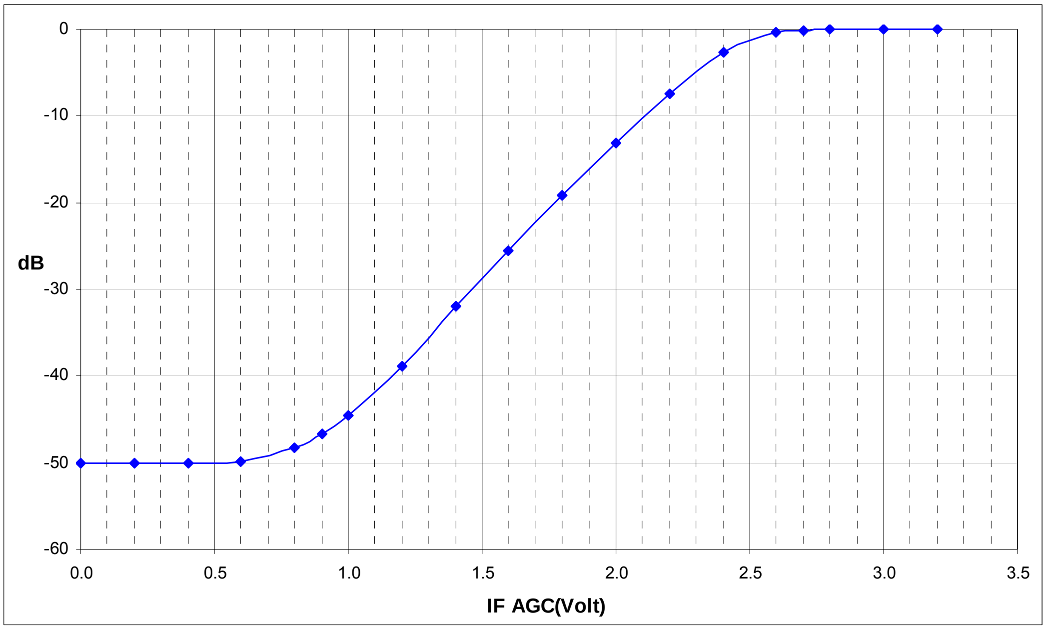

RF AGC Curve at 421.25MHz
dB
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0
Voltage (V)


RF AGC Curve at 553.25MHz
dB
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0
Voltage (V)


RF AGC Curve at 703.25MHz
dB
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0
Voltage (V)


RF AGC Curve at 859.25MHz
dB
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0
Voltage (V)

11.4 Digital IF AGC Slope



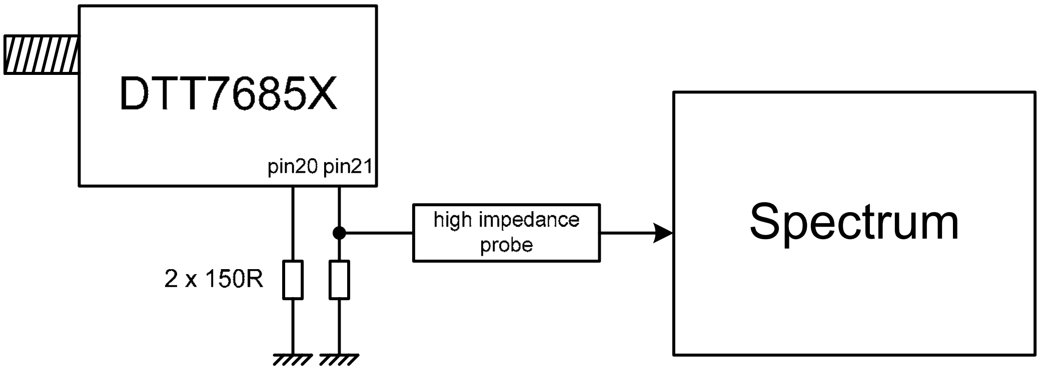
11.5 Digital IF AGC Time Constant (Bandwidth)

The dominant IF AGC time constant τ = 1kΩ × 1nF = 1 μSec typ.

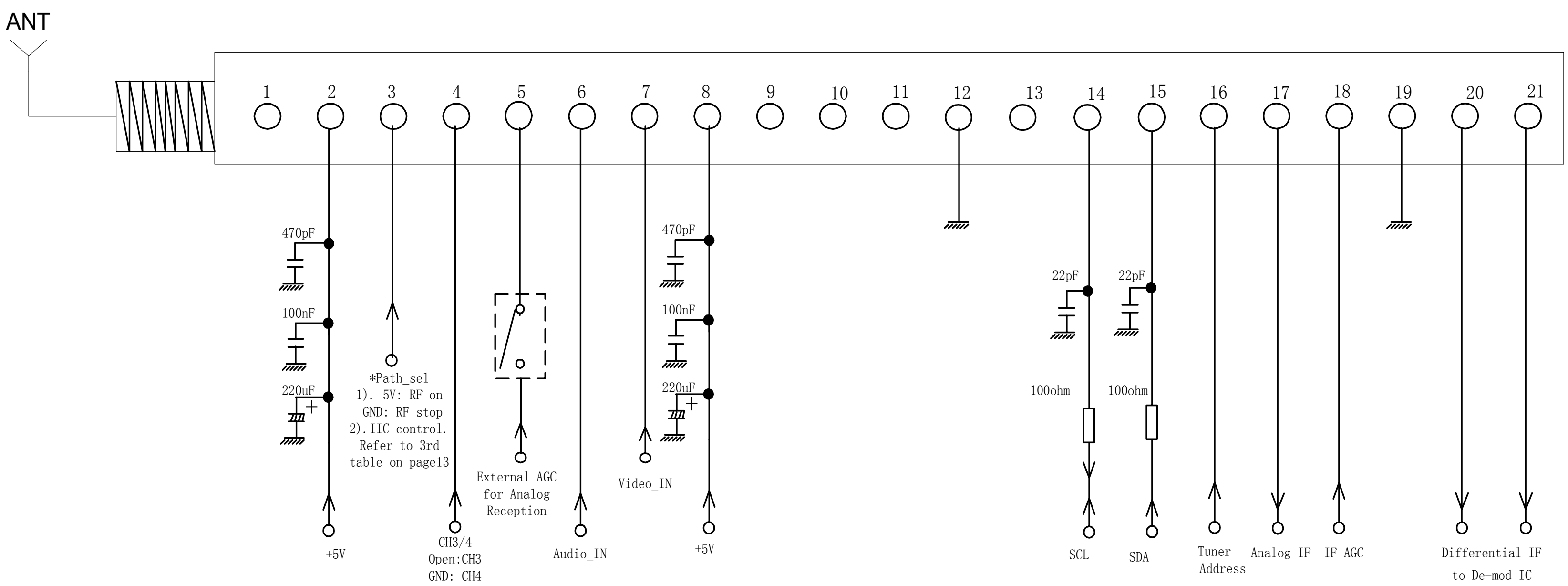
The equivalent bandwidth BW = $1/(2\pi\tau)$ = 159 kHz typ.

11.6 Overall Gain Testing Method

RF AGC: for max gain
IF AGC : 3.0V



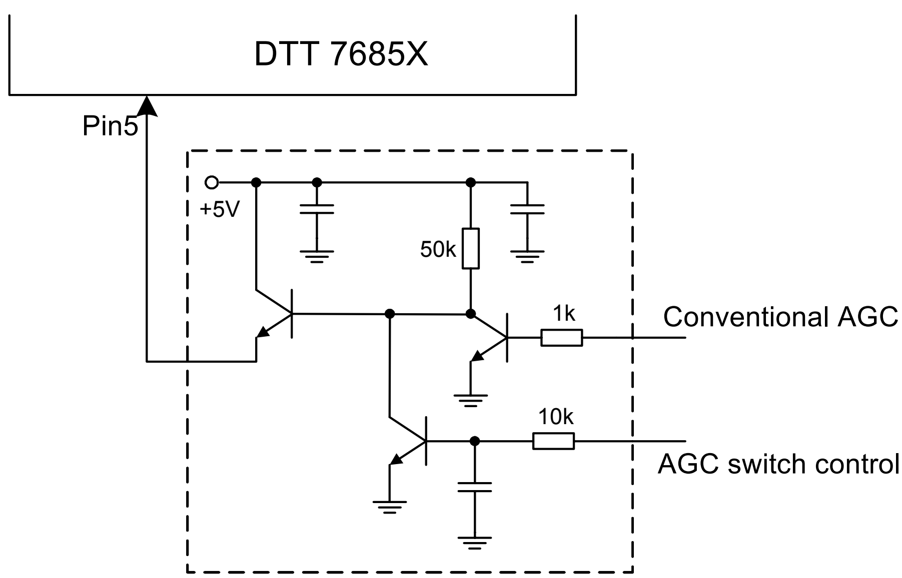
11.7 Application Diagram



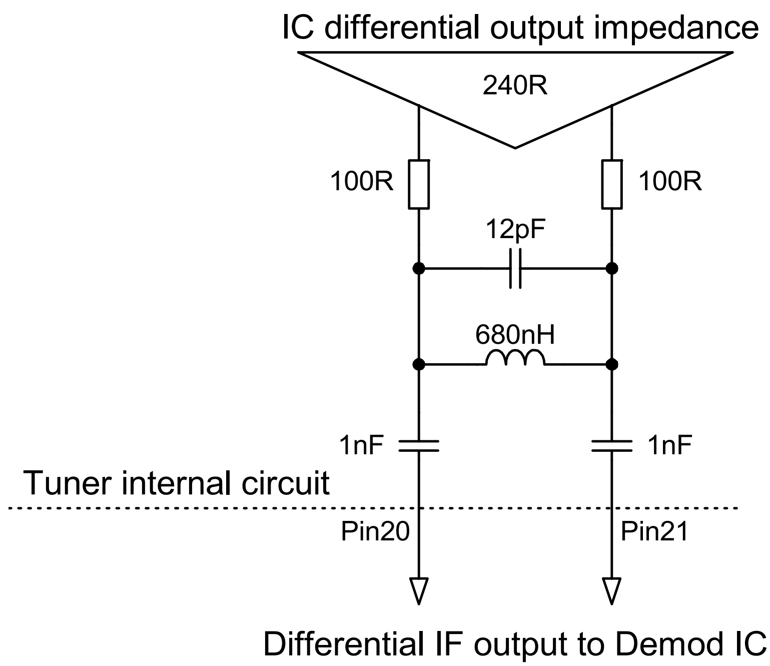
Application note:

1) All tuner supply line, CLK & DATA line decoupling Ceramic capacitor should be place near to Tuner in PCB layout
2) The supply ripple must not more then 10mVp-p
3) Recommend CD6 setting hex “33” for digital reception
4) To ensure correct Time Constant & Filtering for analog application
5) Lug 3 and 4 (L3 & L4) are for holding the tuner module only, do not connect them to a ground plane else it may result in immunity deterioration. Do ensure sufficient isolation of these 2x lugs away from the ground plane to prevent stray capacitance coupling.
6) Lug 1 and 2 (L1 & L2) are for connection to a ground plane. The ground plane should be large for lesser ground inductance hence providing better grounding for the tuner module.
8) For analog reception, set AGD bit to “1” to disable internal wideband AGC

11.8 Recommend AGC switch circuit for analogue reception only



11.9 Internal Differential IF Circuit



13. Revision

Date of Changes	Index	Modification	Pages
4 Oct 06	--	Preliminary spec	1 - 32
8 Jan 07	--	Preliminary spec updates	1 - 31
20 Apr 07	--	Update Horizontal mount tuner mechanical spec, add lug L1~L4 connection information & modulator output level.	All

For more information, contact our nearest sales office or e-mail any request to tuners@thomson.net.

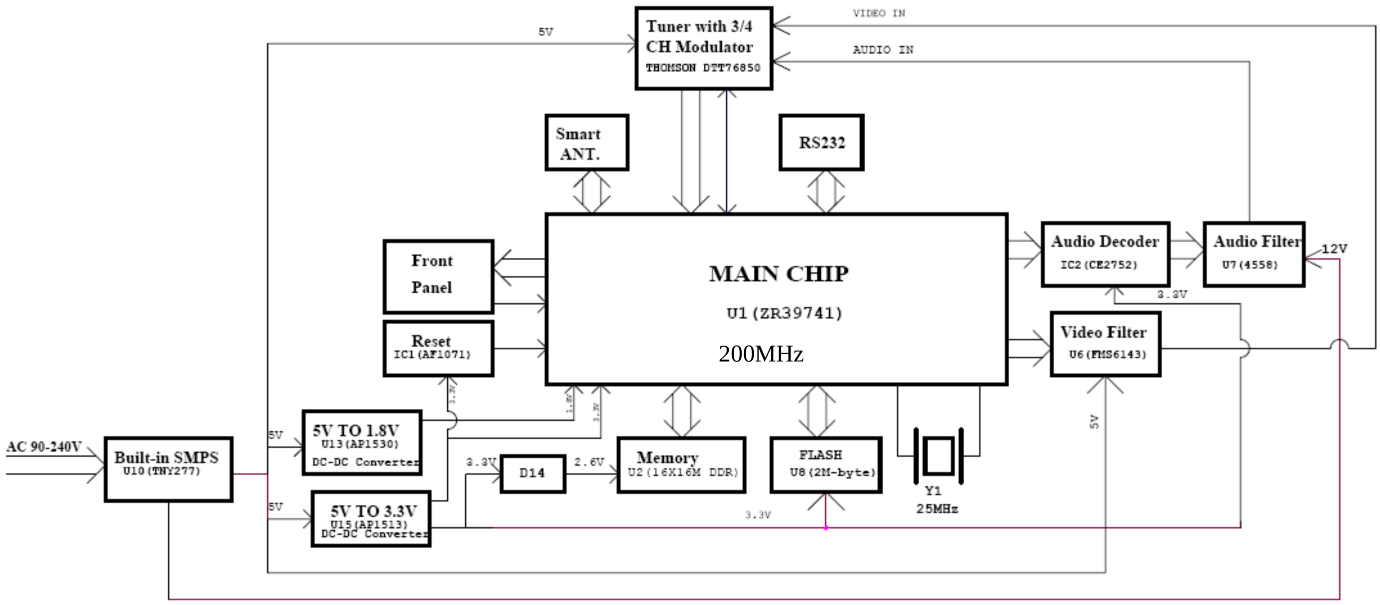
THOMSON – Business Units Tuners

NORTH AMERICA THOMSON Tuners - 12950 Saratoga Ave, Saratoga CA 95070, USA
Tel. + 1 408 387 51 31 - Fax. + 1 408 255 94 14

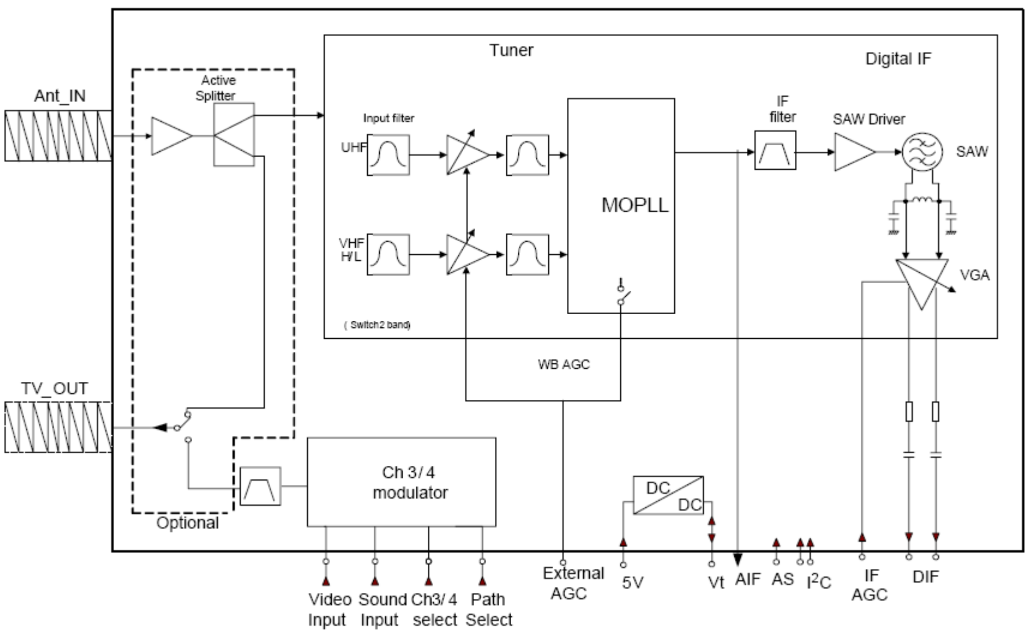
ASIA THOMSON Tuners – 8 Jurong Hall Road #29-01/06 – The JTC Summit – SINGAPORE 609434
Tel. + 65 6 379 17 98 Fax. + 65 6 379 17 75

EUROPE & LATIN AMERICA THOMSON Tuners - 46 quai A Le Gallo - 92648 Boulogne Cedex – FRANCE
Tel. + 33 1 41 86 50 15 - Fax. + 33 1 41 86 56 75

JAPAN THOMSON Tuners Japan – Daini-yanagiya Bldg., 5F
(Grass Valley Japan, Ltd)
1-12-8 Nihonbashi, Chuo-ku
Tokyo 103-0027, JAPAN
Tel. + 81 3 6848 6390 Fax +81 3 6848 6391


Tuner with 3/4
CH Modulator
THOMSON DTT76850
VIDEO IN
AUDIO IN
5V
Smart
ANT.
RS232
MAIN CHIP
U1(ZR39741)
200MHz
Front
Panel
Reset
IC1(AF1071)
Audio Decoder
IC2(CE2752)
Audio Filter
U7(4558)
12V
3.3V
Video Filter
U6(FMS6143)
AC 90-240V
Built-in SMPS
U10(TNY277)
5V TO 1.8V
U13(AP1530)
DC-DC Converter
5V TO 3.3V
U15(AP1513)
DC-DC Converter
D14
2.6V
Memory
U2(16X16M DDR)
FLASH
U8(2M-byte)
Y1
25MHz

EUT


Ant_IN
TV_OUT
Active
Splitter
Optional
Tuner
Digital IF
Input filter
UHF
VHF
H/L
(Switch2 band)
MOPLL
IF
filter
SAW Driver
SAW
VGA
WB AGC
Ch 3/4
modulator
DC
DC
Video Input
Sound Input
Ch3/4 select
Path Select
External AGC
5V
Vt
AIF
AS
I2C
IF AGC
DIF

RF Tuner

March 24, 2008

Shen Zhen MTC Co., LTD
31-32/F., A Xing He Shi Ji Bldg.,
2069 Cai Tian Road,
Shen Zhen, P.R.China

Dear Kang Jian:

Enclosed you will find your file copy of a Part 15 Certification (FCC ID: UVD20071228001).

For your reference, TCB will normally take another 20 days for reviewing the report. Approval will then be granted when no query is sorted.

Please contact me if you have any questions regarding the enclosed material.

Sincerely,

Shawn Xing
Assistant Manager

Enclosure

Intertek Testing Service Shenzhen Ltd. Guangzhou Branch
1~8th floor, Block E2, 11 Cai Pin Road, Science city, Guangzhou Economic Development Zone, Guangzhou, P. R. China
Tel: (8620) 8213 9688 Fax: (8620) 3205 7538

Shen Zhen MTC Co., LTD

Application
For
Certification
(FCC ID: UVD20071228001)

TV Interface Device



GZ08020186-1
Billy Li
March 24, 2008

- The test results reported in this test report shall refer only to the sample actually tested and shall not refer or be deemed to refer to bulk from which such a sample may be said to have been obtained.
- This report shall not be reproduced except in full without prior authorization from Intertek Testing Services Hong Kong Limited.
- For Terms And Conditions of the services, it can be provided upon request.
- The evaluation data of the report will be kept for 3 years from the date of issuance.

Intertek Testing Service Shenzhen Ltd. Guangzhou Branch
1~8th floor, Block E2, 11 Cai Pin Road, Science city, Guangzhou Economic Development Zone, Guangzhou, P. R. China
Tel: (8620) 8213 9688   Fax: (8620) 3205 7538

LIST OF EXHIBITS

INTERTEK TESTING SERVICES

MEASUREMENT/TECHNICAL REPORT

Shen Zhen MTC Co., LTD

MODEL: AT2016
ADDITIONAL MODEL: AT2* (*** can from 001 to 999) / MAT-K50 / DTA1010 / RJ-900ATSC, RJ-1000ATSC / STB-T8, STB-T9, STB-T10**
ATSC Converter Box
FCC ID: UVD20071228001

March 24, 2008

This report concerns (check one:) Original Grant___X___ Class II Change_____

Equipment Type: TV Interface Device (example: TV modulator, etc.)

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes_____ No___X________
If yes, defer until: ___________________date_Company Name agrees to notify the Commission by: _________ date of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? Yes_____ No___X______

If no, assumed Part 15, Subpart B for intentional radiator - the new 47 CFR [09-20-07 Edition] provision.

Report prepared by:

Shawn Xing
Intertek Testing Services Shenzhen Ltd.
Guangzhou Branch
1~8th floor, Block E2, 11 Cai Pin Road,
Sciencecity, Guangzhou Economic
Development Zone, Guangzhou, P. R.China.
Phone: (8620) 8213 9688
Fax: (8620) 3205 7538
Fax: 86-755-8601-6751

Table of Contents

List of attached file

Exhibit type	File Description	filename
Test Report	Test Report	report.pdf
Operation Description	Technical Description	descri.pdf
Test Setup Photo	Radiated Emission	radiated photos.pdf
Test Setup Photo	Conducted Emission	conducted photos.pdf
External Photo	External Photo	external photos.pdf
Internal Photo	Internal Photo	internal photos.pdf
Block Diagram	Block Diagram	block.pdf
Schematics	Circuit Diagram	circuit.pdf
ID Label/Location	Label Artwork and Location	label.pdf
RF Signal	Modulator Signal Output	ch3 and ch4.pdf
User Manual	User Manual	manual.pdf
Cover Letter	Letter of Agency	agency.pdf

EXHIBIT 1

GENERAL DESCRIPTION

1.0 General Description

1.1 Product Description

This Equipment Under Test (EUT) is a ATSC Set Top Box, it used to receive the digital TV signal (ATSC) and demodulate to Audio / Video signal out put via the RF tuner. This EUT is powered by 120V/AC. Besides , it can also modulated the ATSC signal to TV receiver via RF output terminal which is designed to convert the Audio / Video signal to standard NTSC CH3 or CH4 RF signal. There are two different channels available, Channel 3 and Channel 4, it can be selected by the switch on the back panel. A coaxial cable (75 ohm, 0.8m) is provided with this device. Power and channel-select buttons are located on the front panel, most of the input or output terminals are located at the back panel including a smart antenna terminal that can be connected to a terrestrial antenna, the EUT can control the terrestrial antenna gain and direction automatically to optimize the receiving signal via the smart antenna terminal.

Models AT2*** (*** can from 001 to 999), MAT-K50, DTA1010, RJ-900ATSC, RJ-1000ATSC, STB-T8, STB-T9, STB-T10 are identical in the hardware aspect, The difference in model number and trade name serves as marketing strategy.
We have tested one model AT2601 during this compliance test period. For electronic filing, the brief circuit description with the RF tuner specification is saved with filename: descri.pdf.

1.2 Related Submittal(s) Grants

This is a single application for certification of a TV interface device for the function RF modulation of this EUT, and the other function is subject to the FCC part 15 verification.

1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4 (2003). Radiated emission measurement was performed in semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

The Semi-Anechoic Chamber & shielded room facility used to collect the radiated & conducted emissions data is **SHENZHEN ACADEMY OF METROLOGY & QUALITY INSPECTION** located at Longzhu Road, Shenzhen. This test facility and site measurement data have been fully placed on file with the FCC.

EXHIBIT 2

SYSTEM TEST CONFIGURATION

2.0 System Test Configuration

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.4 (2003).

For maximizing emissions below 30 MHz, the EUT was rotated through 360°, the centre of the loop antenna was placed 1 meter above the ground, and the antenna polarization was changed. For maximizing emission at and above 30 MHz, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data report in Exhibit 3.0.

The unit was placed in the rear of the turntable.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was placed on a turn table, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

The frequency range from 30MHz to 2GHz was searched for spurious emissions from the device. Only those emissions reported were detected. All other emissions were at least 20 dB below the applicable limits.

2.2 EUT Exercising Software

There was no special software to exercise the device. Once the unit is powered up, it transmits the typical signal continuously.

2.3 Special Accessories

No special accessories were used for compliance of this product.

2.4 Equipment Modification

Any modifications installed previous to testing by Shenzhen MTC Co., LTD will be incorporated in each production model sold/leased in the United States.

No modifications were installed by Intertek Testing Services

2.5 Measurement Uncertainty

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

2.6 Support Equipment List and Description

This product was tested in the following configuration:

Refer List:

Description	Manufacturer	Model No.	Serial No.
TV-Test Transmitter	ROHDE&SCHWARZ	SFQ	2072.5501.02
MPEG2 Measurement Generator	ROHDE&SCHWARZ	DVG	2068.8600.03
75Ω RF Termination	---	---	---
10 kΩ, 22kΩ, 75Ω, 100Ω Termination loading	---	---	---
1 x 75Ω coaxial cable (Provided by Client)			
3 x 1.5m AV cable	---	---	---
Pass splitter	ROHDE&SCHWARZ	---	800.6612.52
RF cable	---	50Ω, 1.5m	---
50 – 75Ω Matching Pad	---	---	---
Impedance Transformer	NMC	MB-009	---

All the items listed under section 2.0 of this report are

Confirmed by:

Shawn Xing
Assistant Manager
Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Agent for Shenzhen MTC Co., LTD

________________________ *Signature*

March 24, 2008 *Date*

EXHIBIT 3

EMISSION RESULTS

3.0 Emission Results

Data is included worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

3.1 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD + AV

where FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD + AV

3.1 Field Strength Calculation (cont'd)

Example

Assume a receiver reading of 62.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dBµV/m. This value in dBµV/m was converted to its corresponding level in µV/m.

RA = 62.0 dBµV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0 dB

AV = -10 dB

FS = 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32 dBµV/m

Level in µV/m = Common Antilogarithm [(32 dBµV/m)/20] = 39.8 µV/m

3.2 Radiated Emission Configuration Photograph

Worst Case Radiated Emission
at
386.438 MHz

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos.pdf.

3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgement: Passed by 1.2 dB

TEST PERSONNEL:



Signature

Billy Li, Compliance Engineer
Typed/Printed Name

March 24, 2008
Date

Applicant: Shenzhen MTC Co., LTD Date of Test: January 28, 2008
Model: AT2016
Mode: Modulating

Table 1

Radiated Emissions

Polar	Frequency (MHz)	Reading (dBuV)	Pre-Amp (dB)	Antenna factor (dB)	Net at 3m (dBuV/m)	Limit at 3m (dBuV/m)	Margin (dB)
H	38.425	49.8	26.5	9.2	32.5	40.0	-7.5
V	63.046	52.5	26.2	9.3	35.6	40.0	-4.4
H	83.267	52.1	25.8	8.5	34.8	40.0	-5.2
H	377.956	45.3	25.7	23.7	43.3	46.0	-2.7
V	386.438	48.2	25.8	22.4	44.8	46.0	-1.2
V	460.588	44.5	26.0	22.0	40.5	46.0	-5.5
V	980.662	41.8	25.9	23.7	39.6	54.0	-14.4
V	1240.266	39.0	34.8	27.6	31.8	54.0	-22.2
V	1608.357	38.8	35.1	28.3	32.0	54.0	-22.0

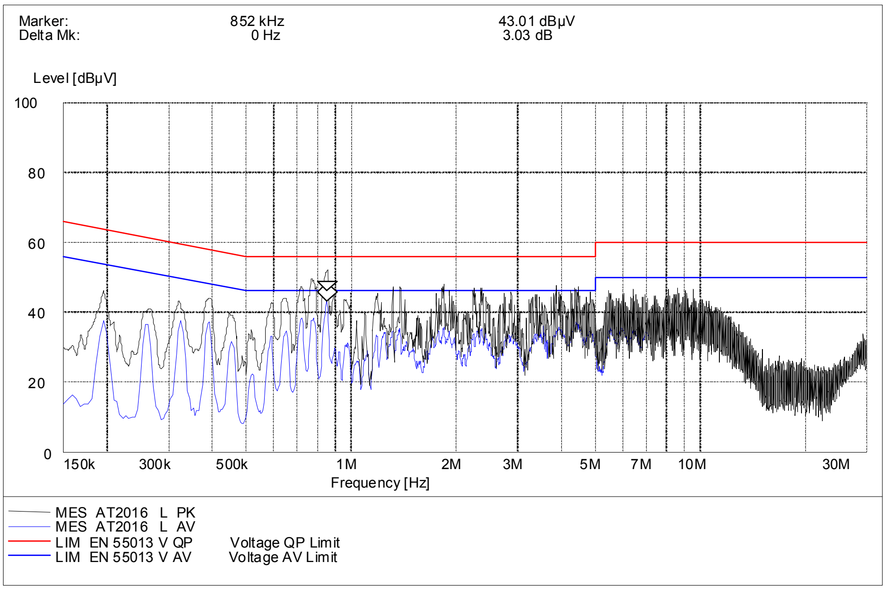
Notes:
1. Peak Detector Data unless otherwise stated.
2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3 meter distance were measured at 0.3 meter and an inverse proportional extrapolation was performed to compare the signal level to the 3 meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3 meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emissions over 1000MHz.
5. The smart antenna port was terminated with 10 kΩ and 100Ω resistor according to the manufacturer’s specification.

Test Engineer: Billy Li

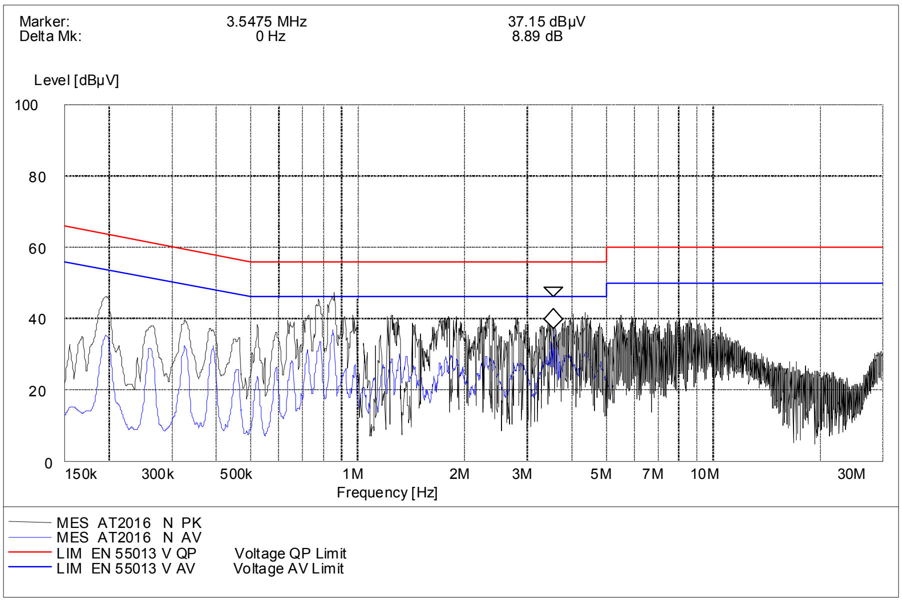
3.4 Conducted Emission Configuration Photograph

Worst Case Line-Conducted Configuration
At
0.852 MHz

For electronic filing, the worst case conducted emission configuration photograph is saved with filename: conducted photos.pdf.



Live Line



Neutral Line

3.5 Conducted Emission Data

Judgement: Passed by 3.2 dB

TEST PERSONNEL:

____
Signature

Billy Li, Compliance Engineer
Typed/Printed Name

March 24, 2008
Date

Applicant: Shenzhen MTC Co., LTD
Date of Test: January 29, 2008
Model: AT2016
Mode: Modulating

Table 2

Conducted Emissions

Live Line Data

Frequency (MHz)	Quasi-Peak		Average	
	Disturbance level dB(μV)	Permitted limit dB(μV)	Disturbance level dB(μV)	Permitted limit dB(μV)
0.784	49.5	56.0	40.1	46.0
0.852	50.5	56.0	42.8	46.0
1.389	42.6	56.0	35.8	46.0
2.255	40.8	56.0	32.5	46.0
3.893	39.5	56.0	31.7	46.0
4.533	38.6	56.0	30.2	46.0

Neutral Line Data

Frequency (MHz)	Quasi-Peak		Average	
	Disturbance level dB(μV)	Permitted limit dB(μV)	Disturbance level dB(μV)	Permitted limit dB(μV)
0.228	48.5	62.5	37.8	52.5
0.784	45.2	56.0	36.5	46.0
0.852	46.1	56.0	37.8	46.0
1.292	39.5	56.0	30.2	46.0
3.547	39.1	56.0	37.2	46.0
4.448	38.6	56.0	29.8	46.0

Test Engineer: Billy Li

3.6 RF Output Level Measurement

Worst Case Line-Conducted Configuration
At
61.250 MHz

For electronic filing, the plot shows the RF output signal are saved with filename: ch3.pdf. and ch4.pdf

3.7 RF Output Level Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgement: Passed by 4.0 dB

TEST PERSONNEL:



Signature

Billy Li, Compliance Engineer
Typed/Printed Name

March 24, 2008
Date

Applicant: Shenzhen MTC Co., LTD
Date of Test: March 20, 2008
Model: AT2016
Mode: Modulating

Table 3
RF Output Level Measurement

Test Mode	C hannel	Type	Frequency (M H z)	Meter Reading (dBμV)	Pad Loss (dB)	Result (dB μV)	Lim it (dB μV)	Margin (dB)
DTV	03	Aural	56.750	46.2	6.0	52.2	56.5	-4.3
	03	Visual	61.250	59.5	6.0	65.5	69.5	-4.0
	03	Aural	65.750	46.1	6.0	52.1	56.5	-4.4
DTV	04	Aural	62.750	46.4	6.0	52.4	56.5	-4.1
	04	Visual	67.250	58.5	6.0	64.5	69.5	-5.0
	04	Aural	71.750	46.2	6.0	52.2	56.5	-4.3

NOTES: 1. Test according to section 12.2.5 of ANSI C63.4

2. 50 to 75Ω (6dB attenuation) matching-impedance pad was employed.

3. Negative sign in the column shows value below limit.

4. Technical Limits: Video signal: 346.4 ×√R in microvolts = 3000.0μV or 69.5dBμV Audio signal: 77.5 ×√R in microvolts = 671.0μV or 56.5dBμV

Test Engineer: Billy Li

3.8 Spurious Emission Measurement

Conducted spurious emissions measurement more than 4.6MHz below or 7.4MHz above the carrier frequency.

1 The range for measurement is from 30MHz to 4.6MHz below the visual carrier frequency, and any emissions in range from 7.4MHz above the visual carrier frequency to 1G.
2 The measuring instrument was set to 100kHz bandwidth and the detector function to peak mode.
3 Technical Limits: −4.6MHz of video carrier frequency and +7.4MHz shall not exceed $10.95 \times \sqrt{R}$ in microvolts or 39.5dBμV.

3.9 Spurious Emission Measurement Data

Test Mode	Channel	Frequency (MHz)	Meter Reading (dBμV)	Pad Loss (dB)	Amplifier (-dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)
DTV	03	56.250	56.9	6.0	26.0	36.9	39.5	-2.6
DTV	04	62.290	55.8	6.0	26.0	35.8	39.5	-3.7

The worst case emission for more than 4.6MHz below or 7.4MHz above the carrier frequency was showed as above. And all spurious emission was measured and found to be at least 20 dB below the limit.

TEST PERSONNEL:



Signature

Billy Li, Compliance Engineer
Typed/Printed Name

March 24, 2008
Date

3.10 Antenna Transfer Switch Measurement

Worst Case Transfer Switch Emission
At
61.250 MHz

3.11 Antenna Transfer Switch Measurement Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgement: Passed by 8.0 dB

TEST PERSONNEL:



Signature

Billy Li, Compliance Engineer
Typed/Printed Name

March 24, 2008
Date

Applicant: Shenzhen MTC Co., LTD	Date of Test: March 19, 2008
Model: AT2016
Mode: Modulating

Table 4 Antenna Transfer Switch Measurement Pursuant to FCC Part 15 Section 15.115 Requirement

Channel	Frequency (M Hz)	Reading (dBμV)	Pre-am p (dB)	Pad + Pass splitter Loss (dB)	Result (dBμV)	Lim it (dBμV)	Margin (dB)
03	61.250	12.0	22.5	12.0	1.5	9.5	-8.0
04	67.250	11.8	22.5	12.0	1.3	9.5	-8.2

NOTES: 1. Test according to section 12.2.6 of ANSI C63.4

2. A pass splitter (6dB attenuation) and a 50 to 75Ω (6dB attenuation) matching-impedance pad were employed.

3. Negative sign in the column shows value below limit.

4. The measuring instrument was set to 100kHz bandwidth and the detector function to peak mode

5. Limit should not exceed 3.0μV or 9.5dBμV.

Test Engineer: Billy Li

EXHIBIT 4

EQUIPMENT PHOTOGRAPHS

4.0 Equipment Photographs

For electronic filing, the photographs of the tested EUT are saved with filename: external photos.doc & internal photos.doc.

EXHIBIT 5

PRODUCT LABELLING

5.0 Product Labelling

For electronic filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

EXHIBIT 6

TECHNICAL SPECIFICATIONS

6.0 Technical Specifications

For electronic filing, the block diagram and schematics of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

EXHIBIT 7

INSTRUCTION MANUAL

7.0 Instruction Manual

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

EXHIBIT 8

MISCELLANEOUS INFORMATION

8.0 **Miscellaneous Information**

This miscellaneous information includes emission measuring procedure.

8.1 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of EUT operating under Part 15, Subpart B rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 - 2003.

The equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusted through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

Detector function for radiated emissions from the frequency band 30MHz to 1GHz is in QP mode and RBW setting is 120kHz. Detector function for radiated emissions for frequency band above 1GHz, both peak and AV detectors shall be used to measure the emissions and the peak limit is 20dB above the maximum permitted average emission limit and RBW setting is 1MHz. Detector function for conducted emissions are in QP & AV mode and IFBW setting is 9kHz from the frequency band 150kHz to 30MHz.

For radiated emission, the frequency range scanned is 30MHz to 2GHz. For line-conducted emissions, the range scanned is 150kHz to 30MHz.

8.1 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

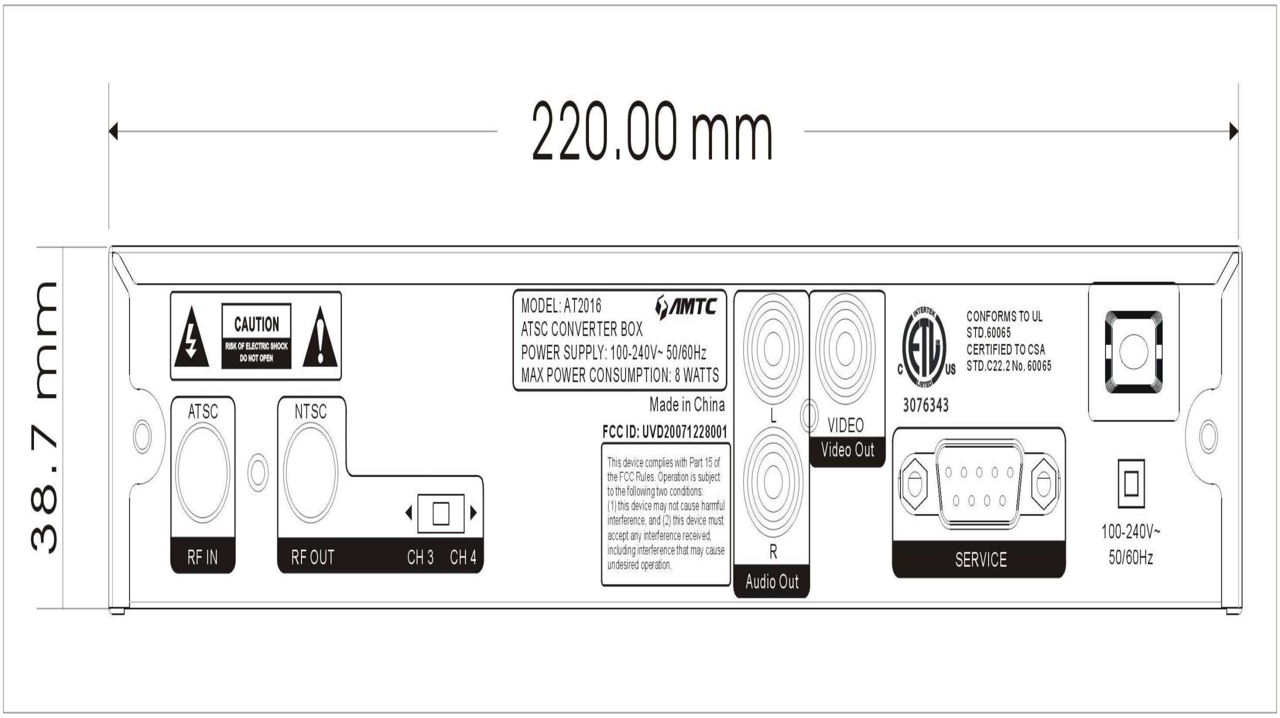
AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements are made as described in ANSI C63.4 - 2003.

External Photo

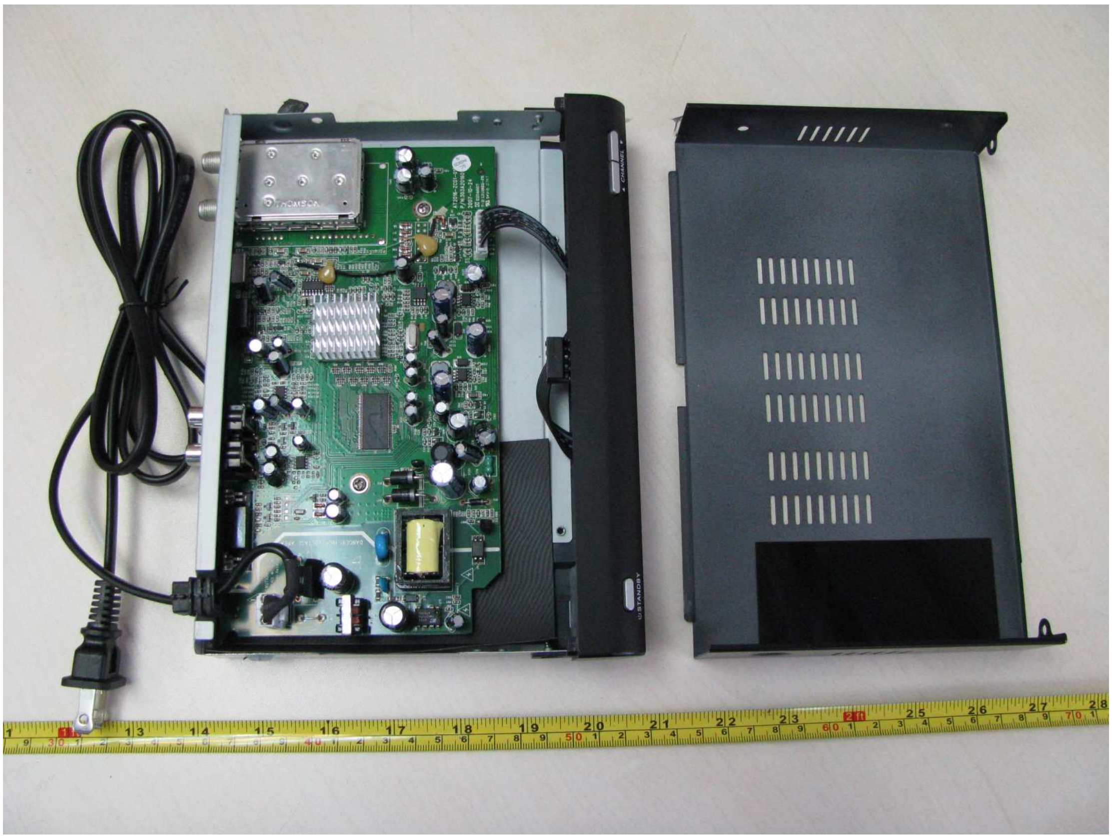


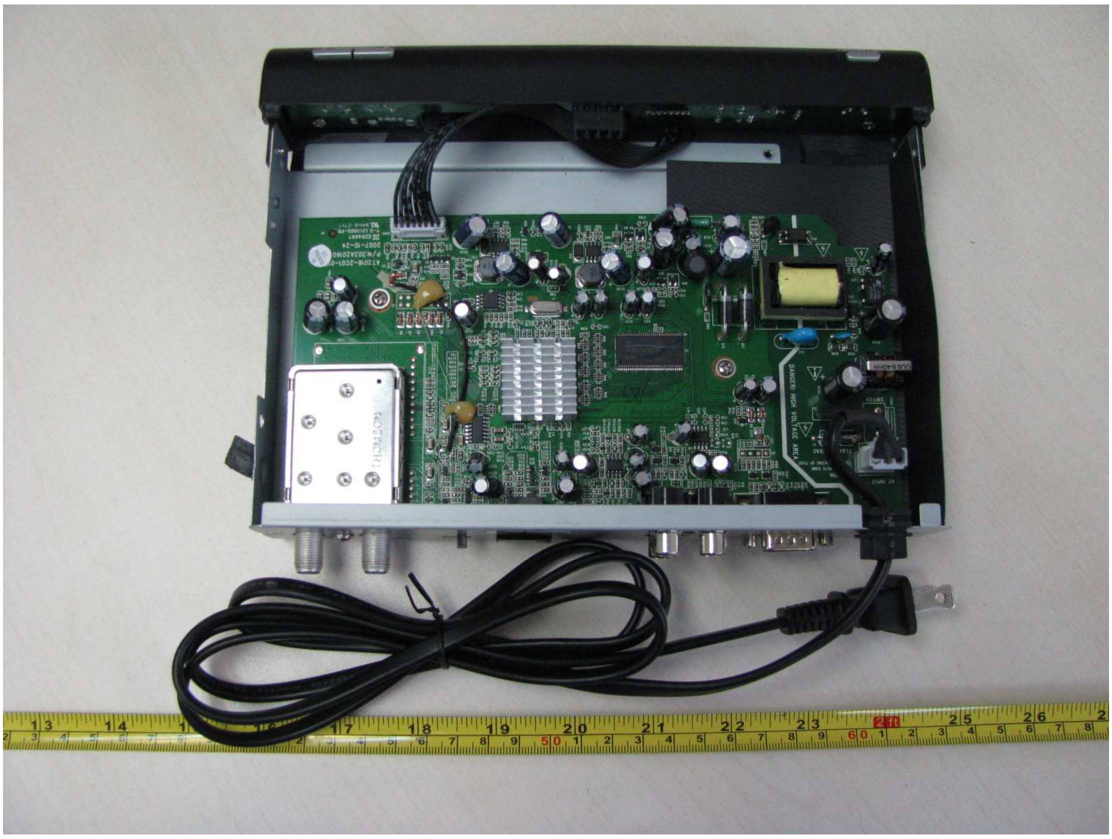


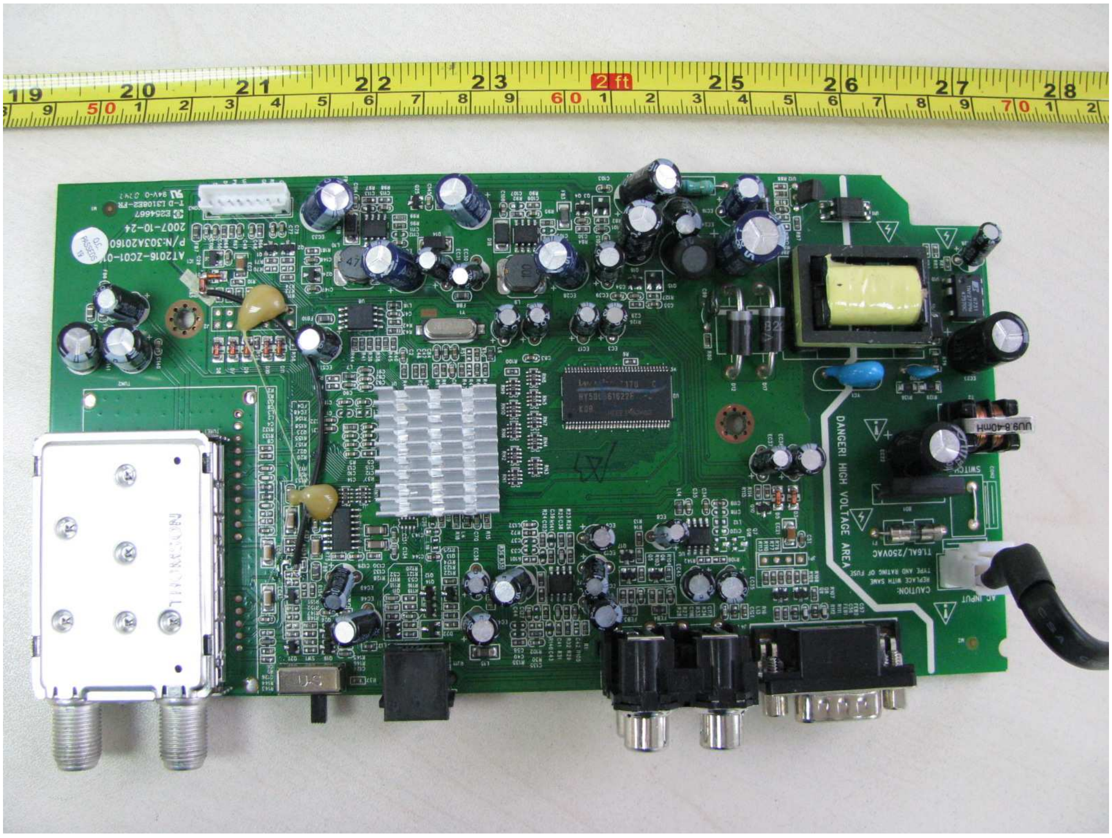


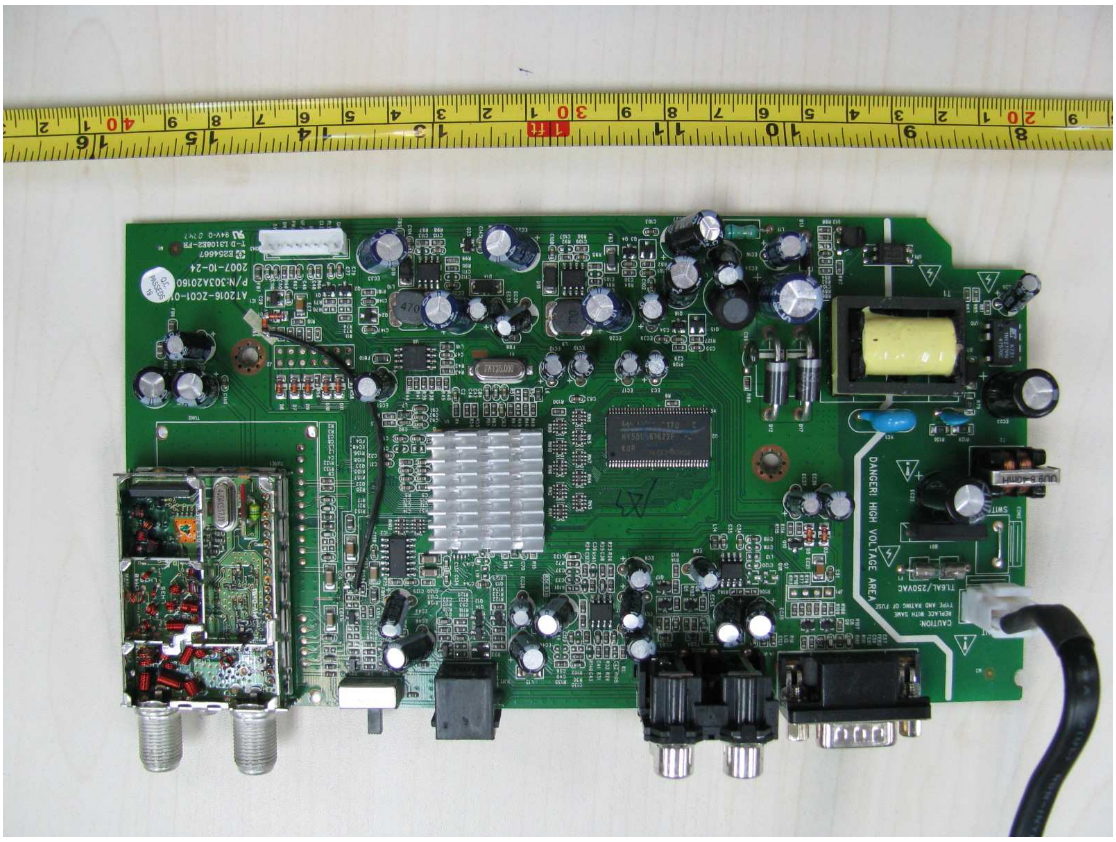
220.00 mm
38.7 mm
CAUTION
RISK OF ELECTRIC SHOCK
DO NOT OPEN
MODEL: AT2016
AMTC
ATSC CONVERTER BOX
POWER SUPPLY: 100-240V~ 50/60Hz
MAX POWER CONSUMPTION: 8 WATTS
Made in China
FCC ID: UVD20071228001
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
ATSC
RF IN
NTSC
RF OUT
CH 3
CH 4
L
R
Audio Out
VIDEO
Video Out
C
US
3076343
CONFORMS TO UL
STD.60065
CERTIFIED TO CSA
STD.C22.2 No. 60065
SERVICE
100-240V~
50/60Hz

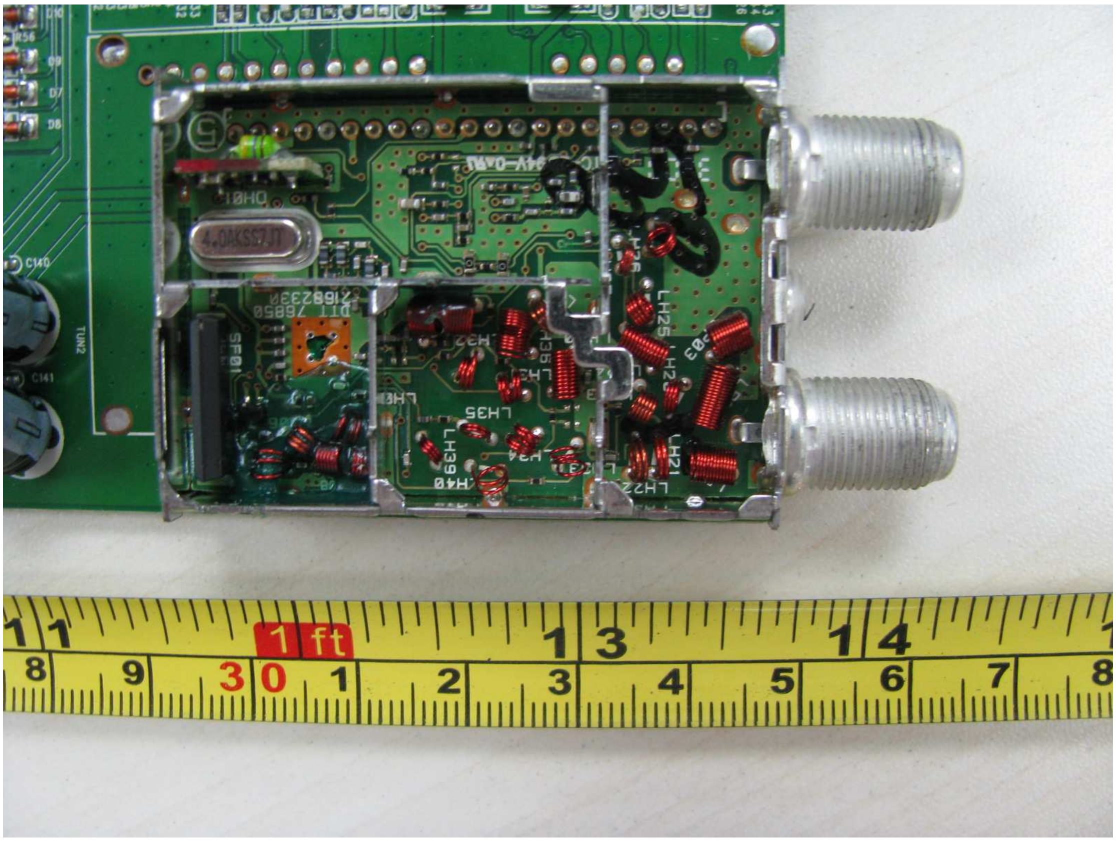
Internal Photo

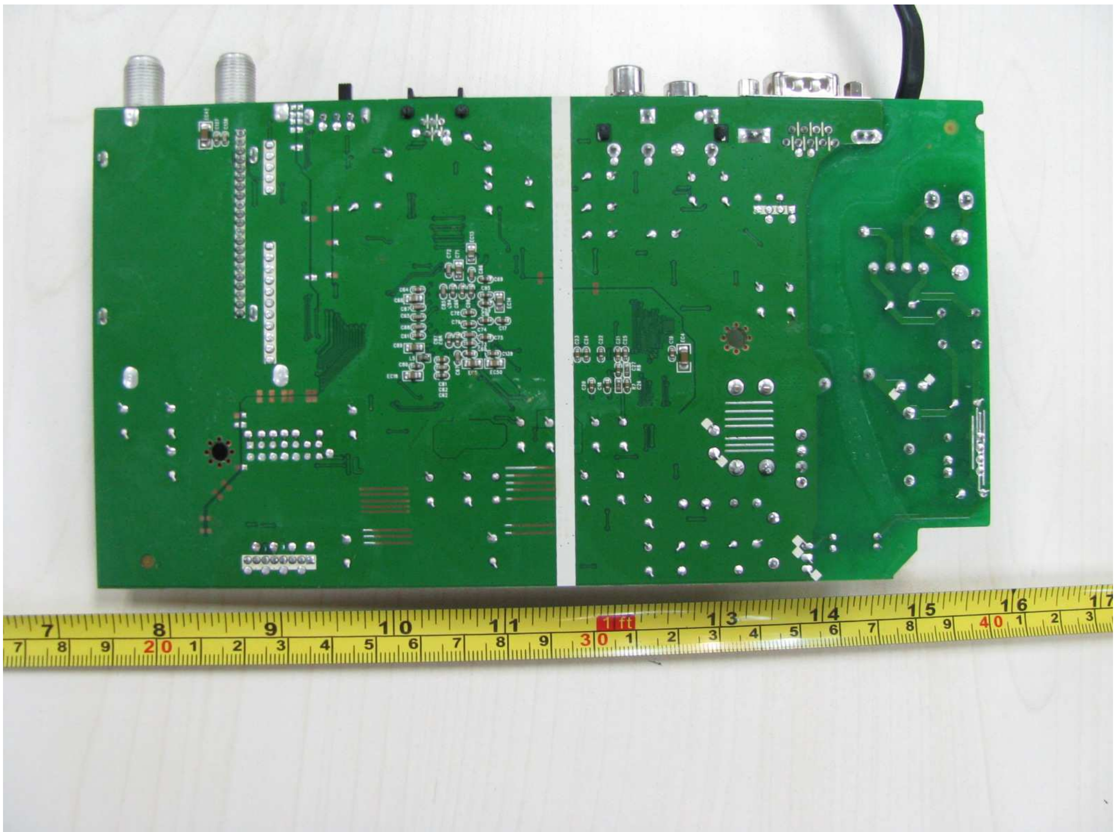


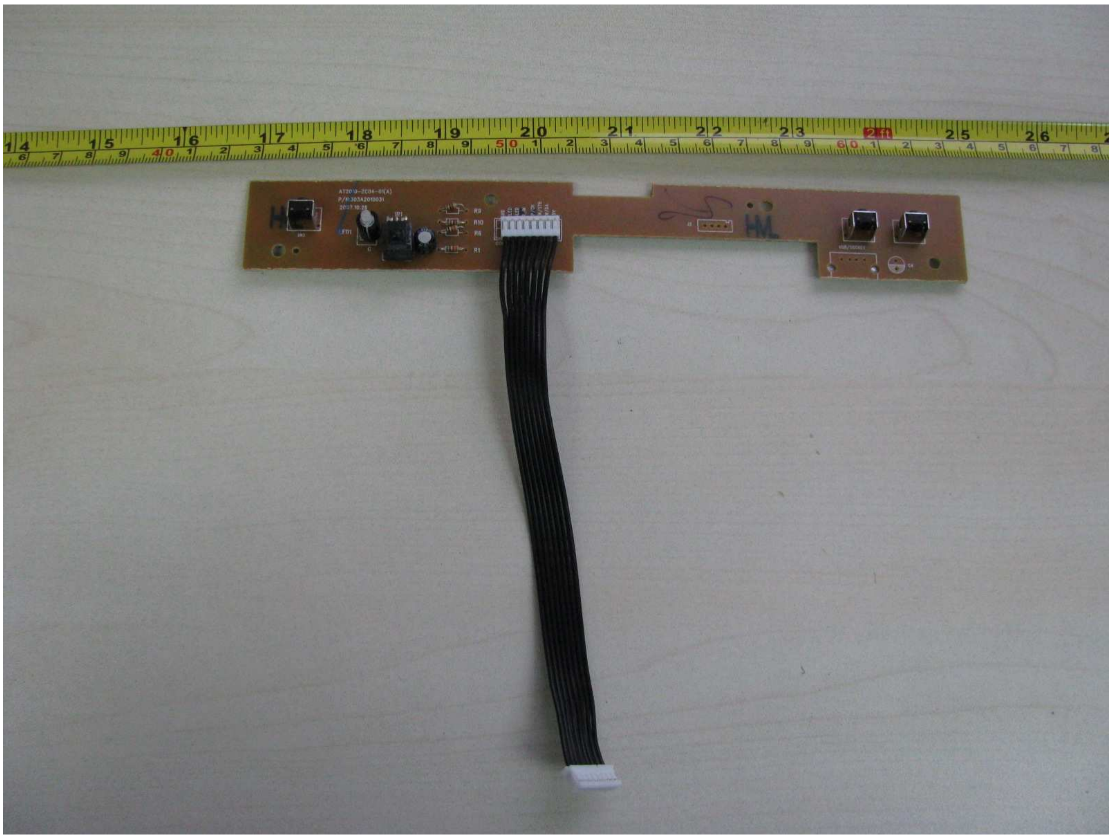


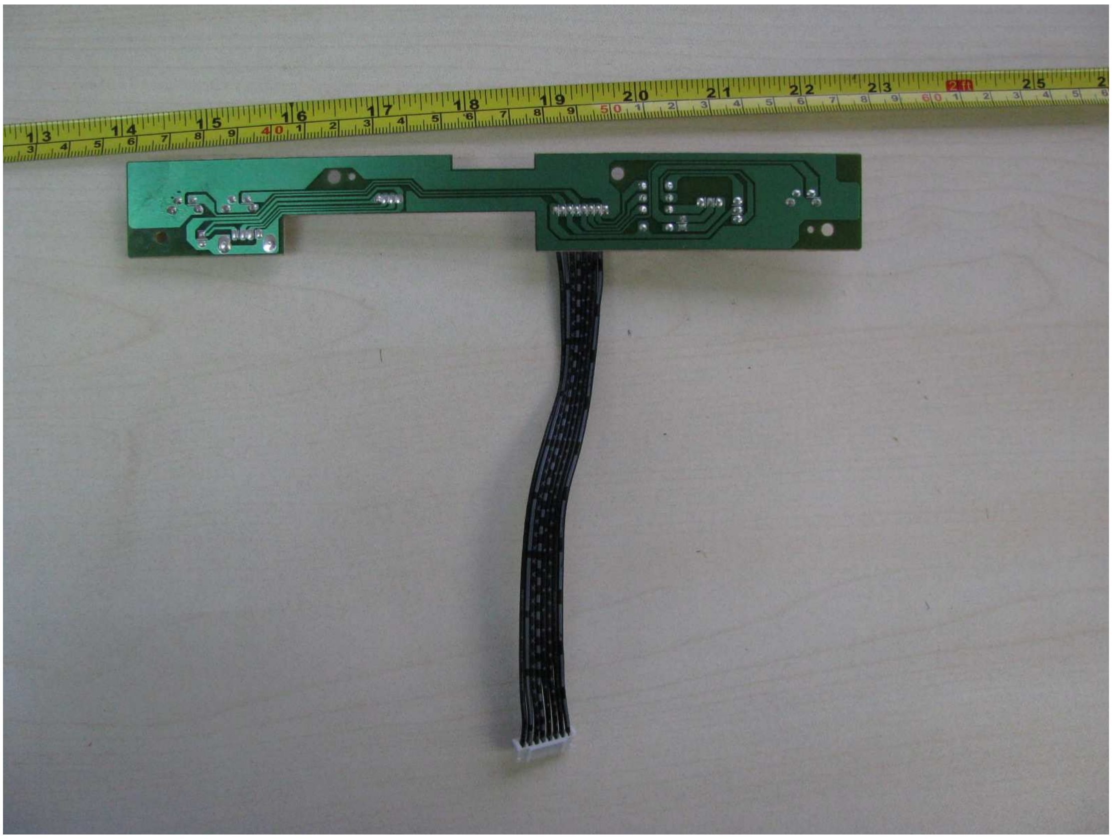

DANGER! HIGH VOLTAGE AREA
T1.6AL/250VAC
2007-10-24


DANGER! HIGH VOLTAGE AREA
T1.6AL/250VAC
2007-10-24

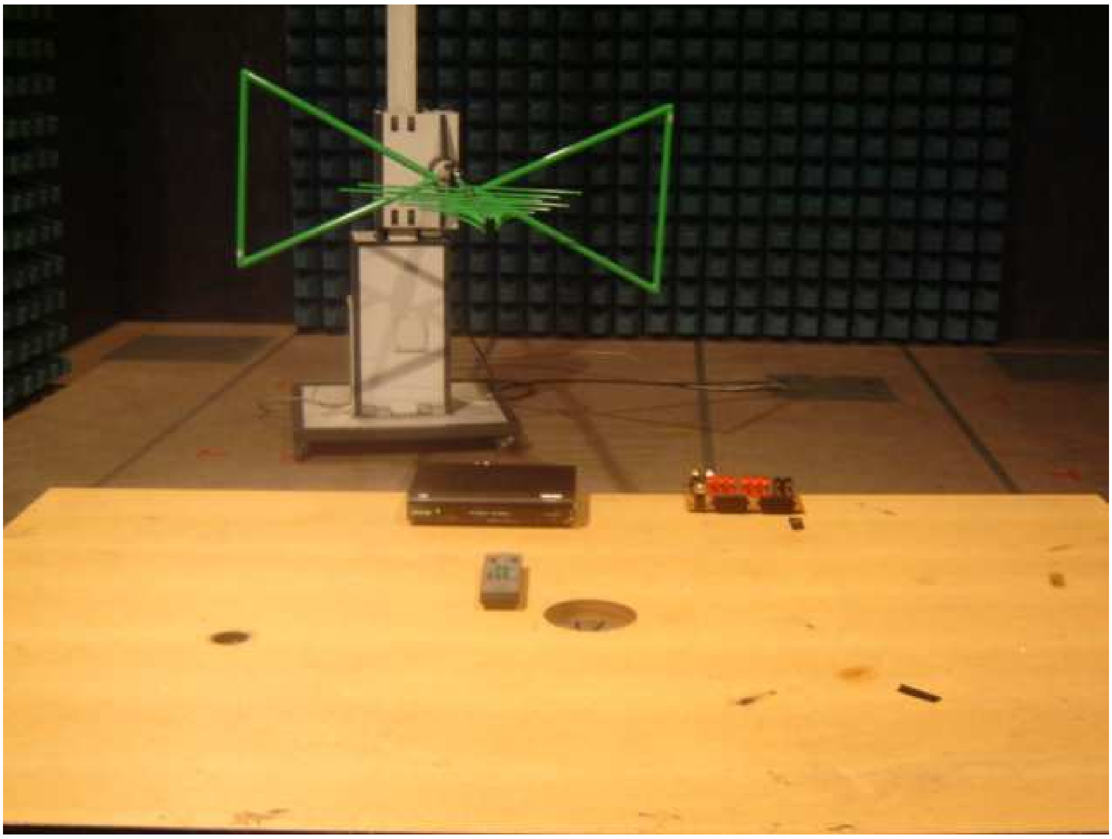

LH35
1 ft

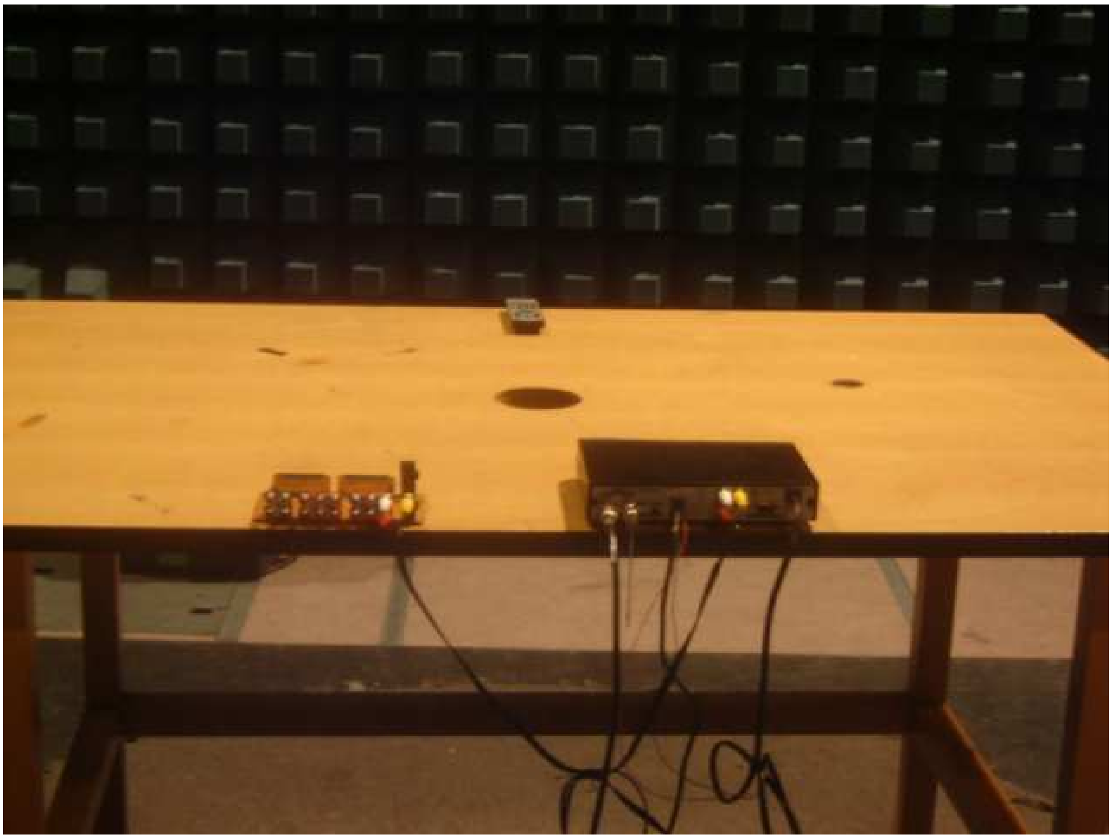

1 ft





Radiated Photo

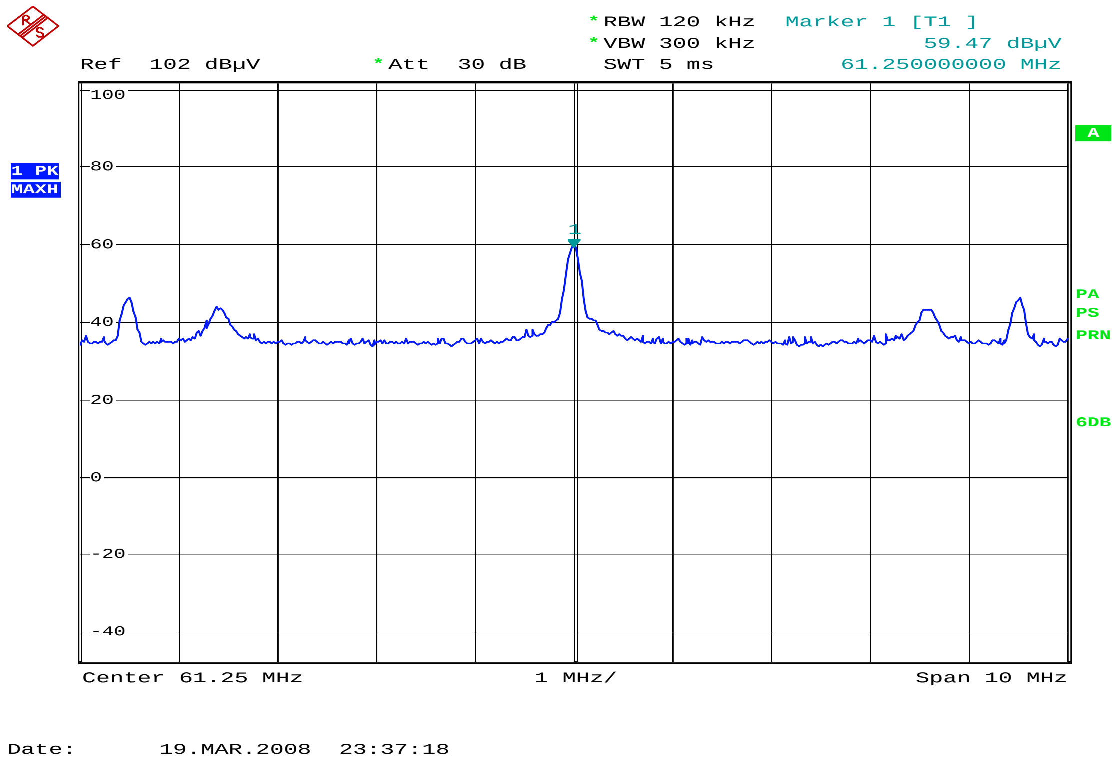




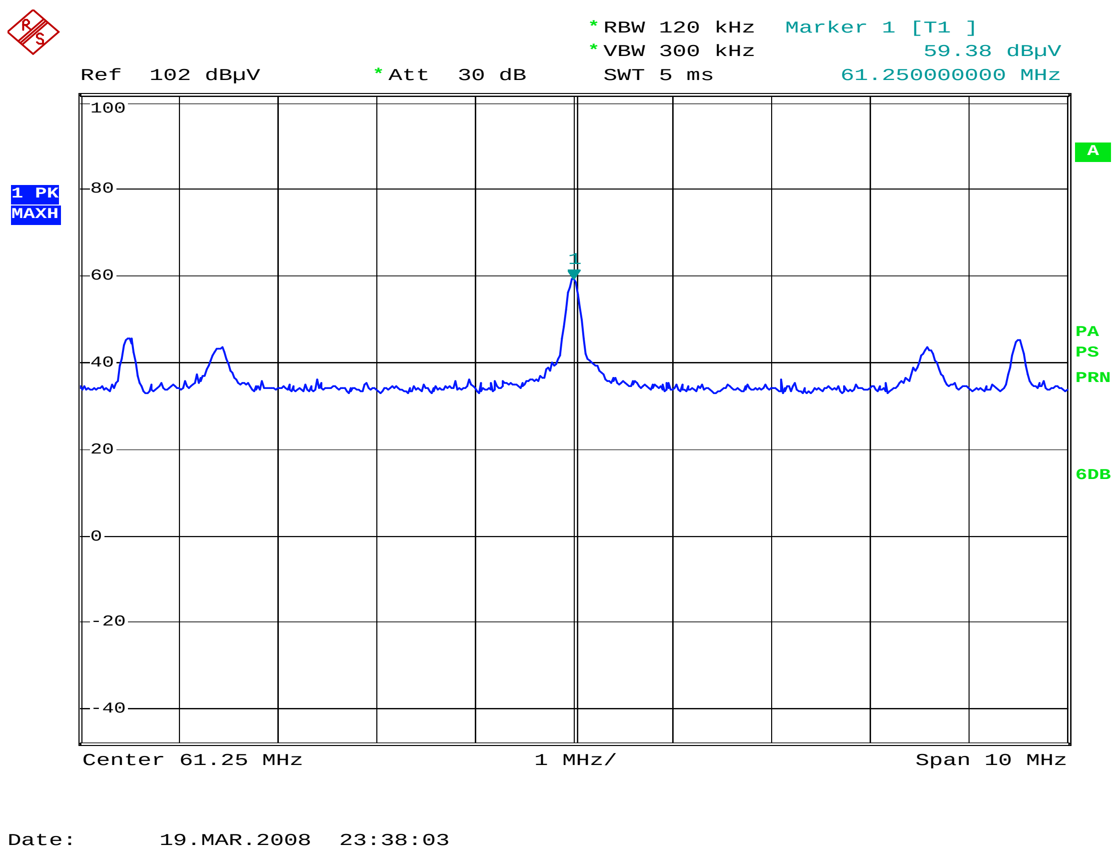
Conducted Photo



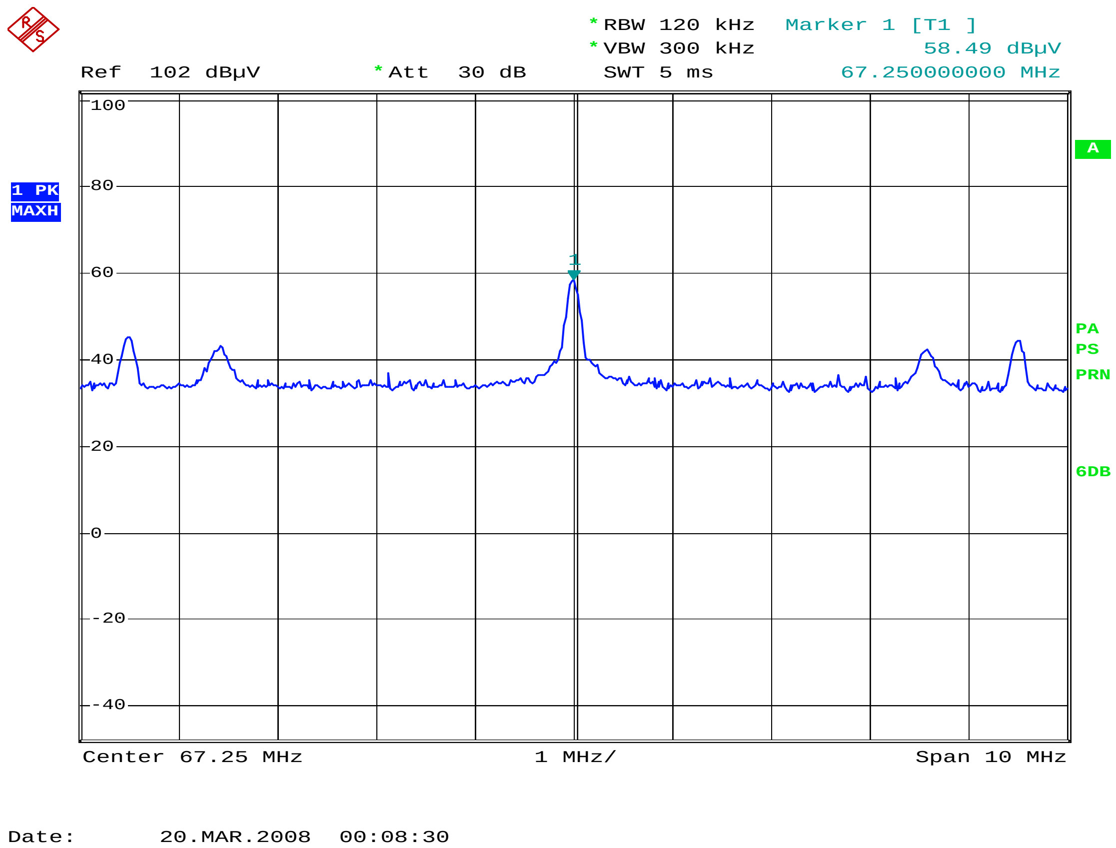




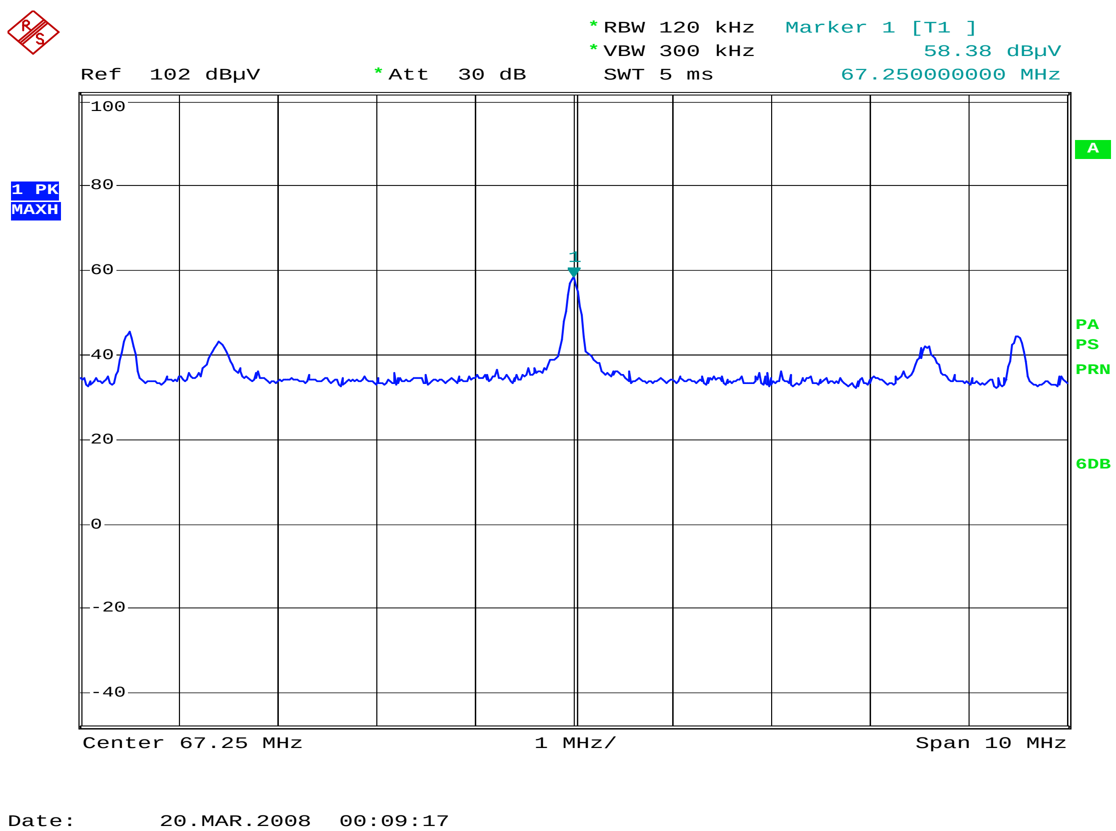
Input Signal: 0dBmV



Input Signal: 25dBmV



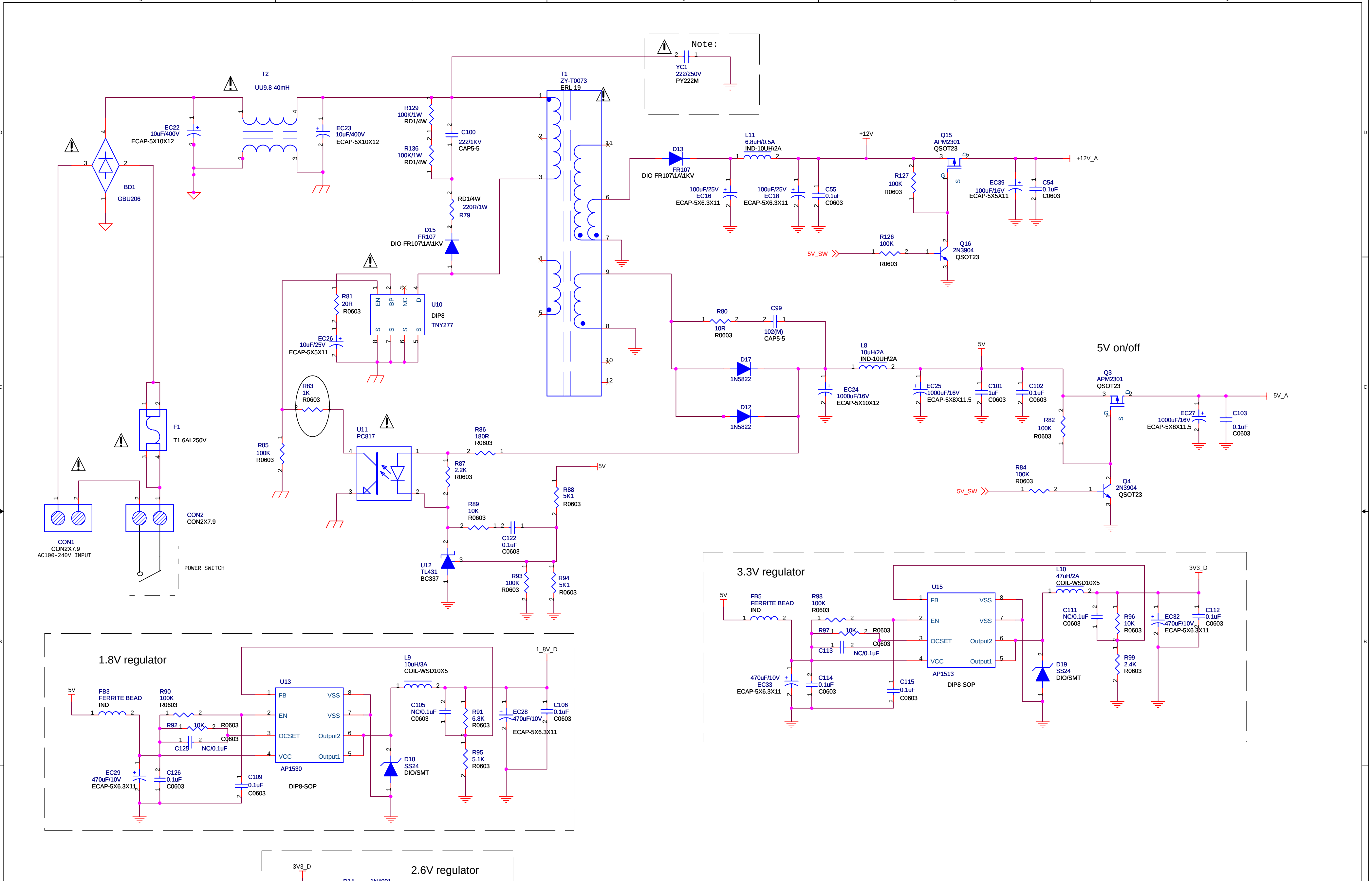
Input Signal: 0dBmV



Input Signal: 25dBmV

AT2016(ZR39741) SCHEMATEIC DIAGRAM

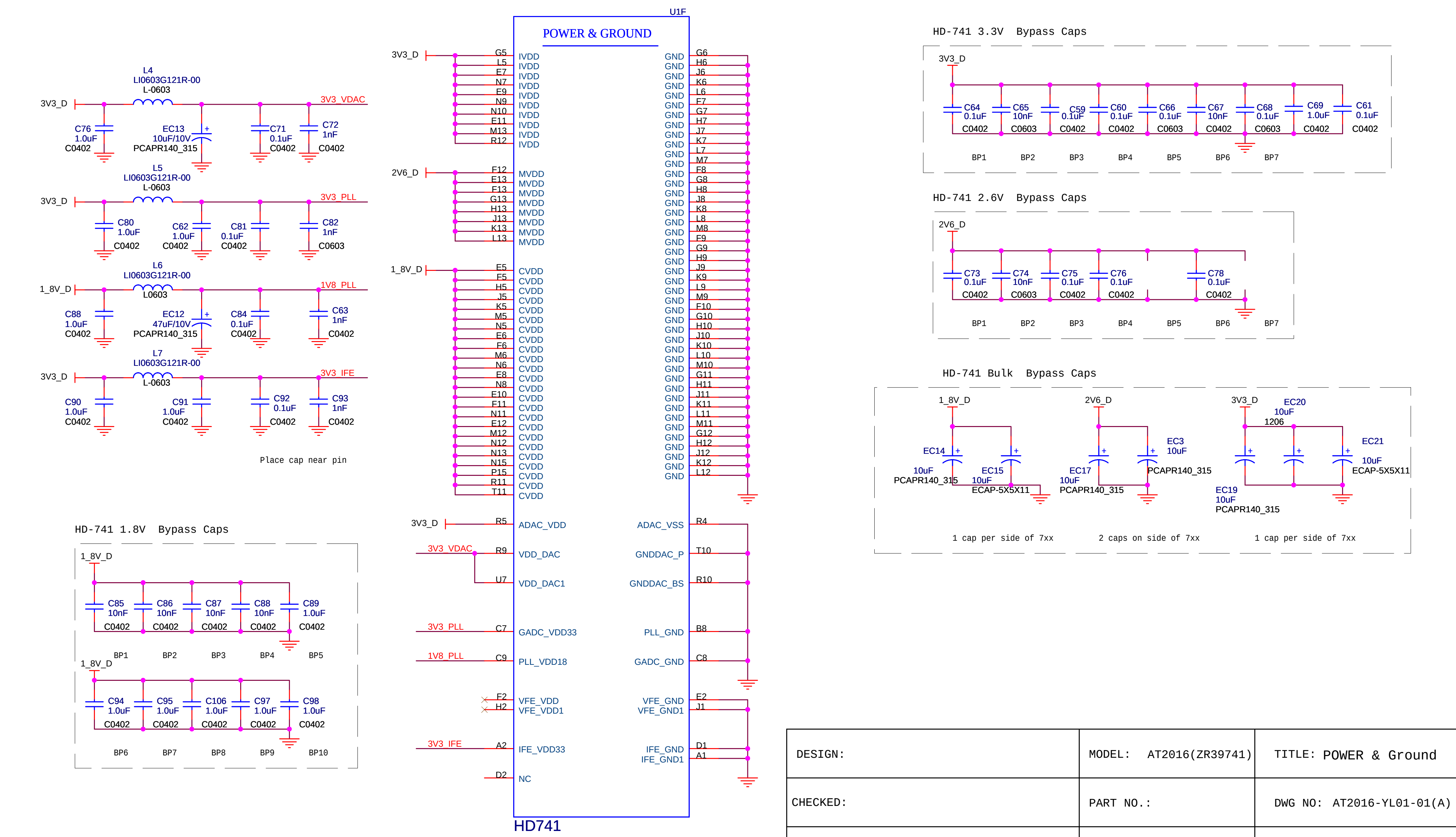
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CHECKED:	PART NO.:	DWG NO: AT2016-YL01-01(A)
APPRD:	SHEET: 1 OF 11	VER: A
SHENZHEN MTC MULTIMEDIA CO.,LTD		



Power Supply

DESIGN:	MODEL: AT2016(ZR39741)	TITLE: POWER SUPPLY
CHECKED:	PART NO.:	DWG NO: AT2016-YL01-01(A)
APPRD:	SHEET: 2 OF 11	VER: A

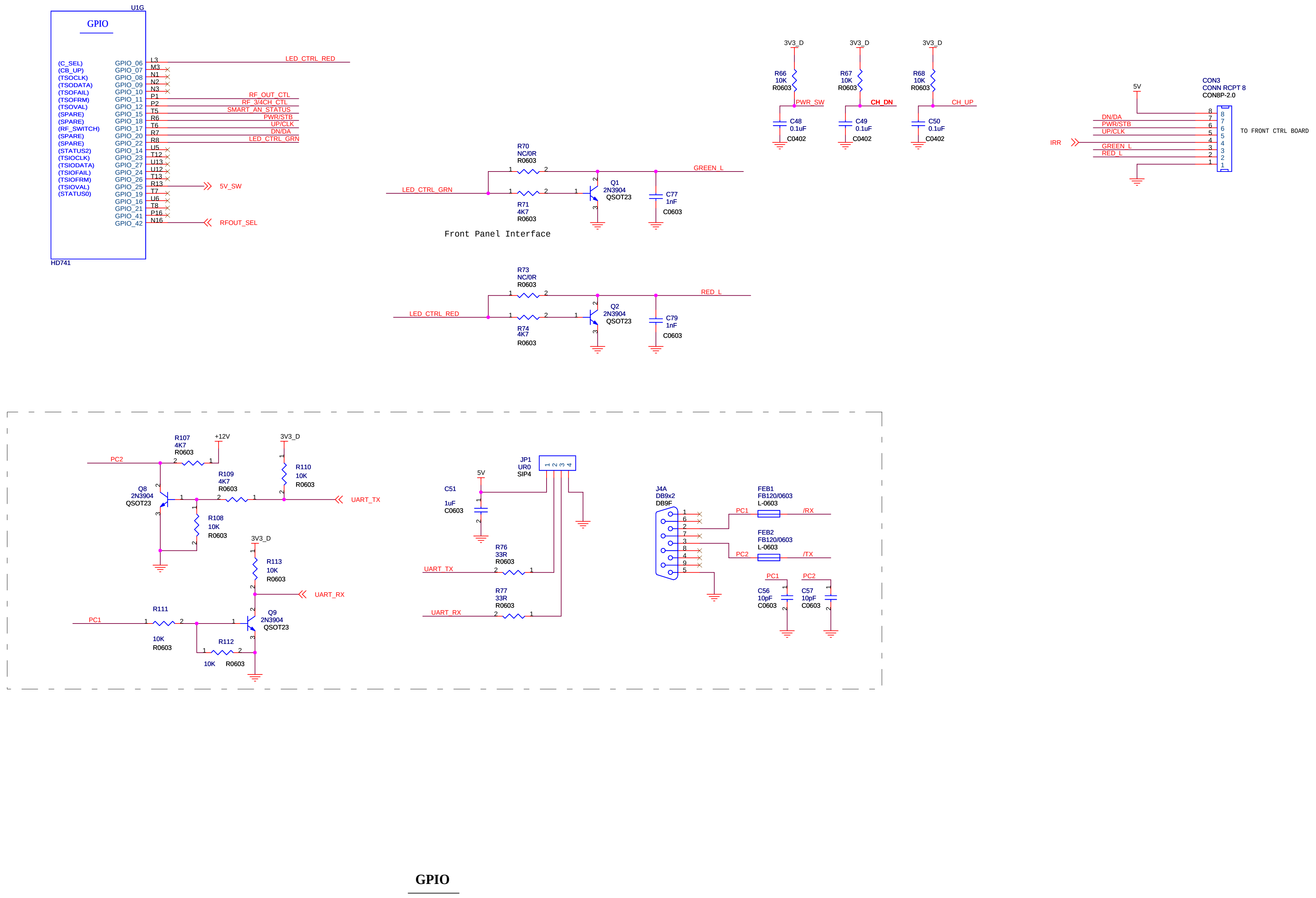
SHENZHEN MTC MULTIMEDIA CO.,LTD



Power and Ground 1

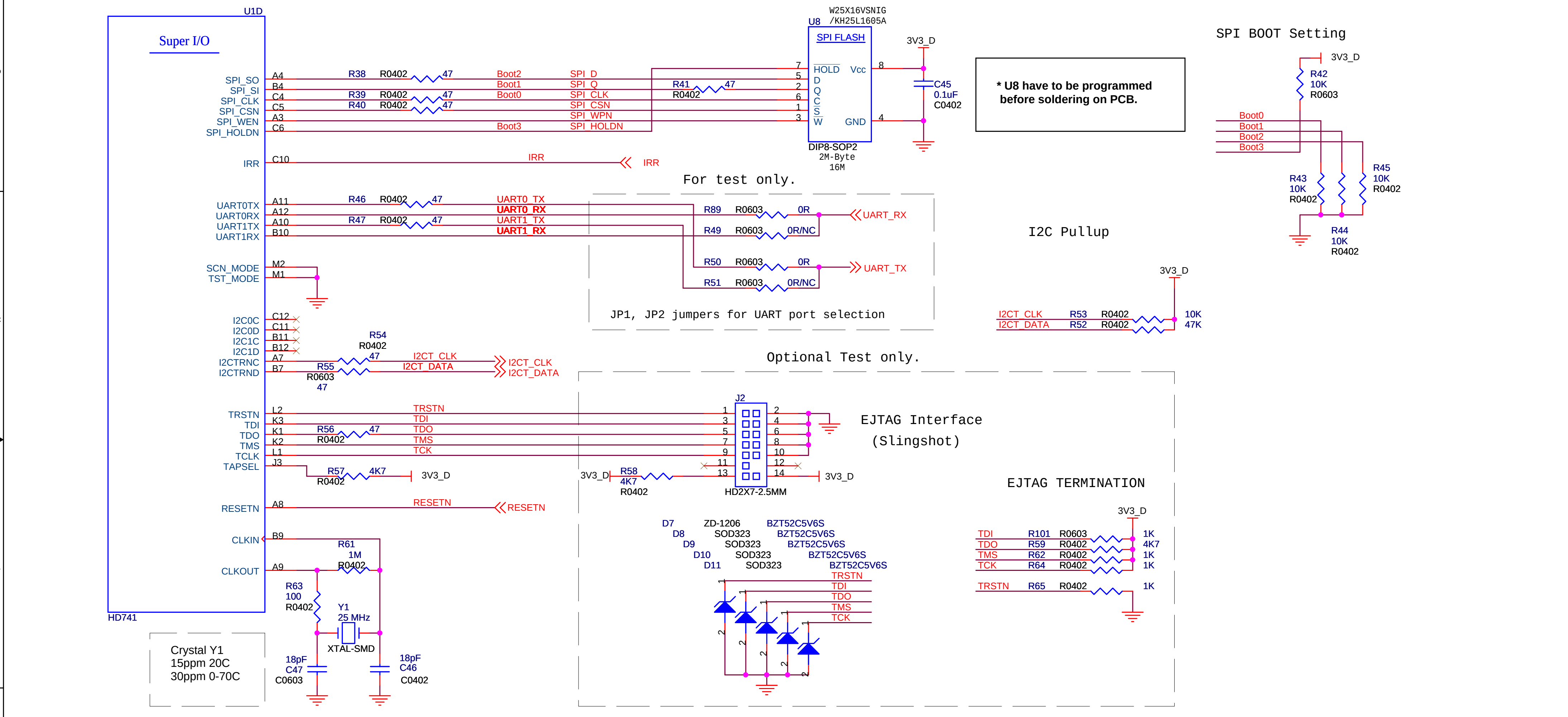
DESIGN:	MODEL: AT2016(ZR39741)	TITLE: POWER & Ground
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APPRD:	SHEET: 3 OF 11	VER: A

SHENZHEN MTC MULTIMEDIA CO.,LTD



DESIGN:	MODEL: AT2016(ZR39741)	TITLE: GPIO
CHECKED:	PART NO.:	DWG NO: AT2016-YL01-01(A)
APPRD:	SHEET: 4 OF 11	VER: A

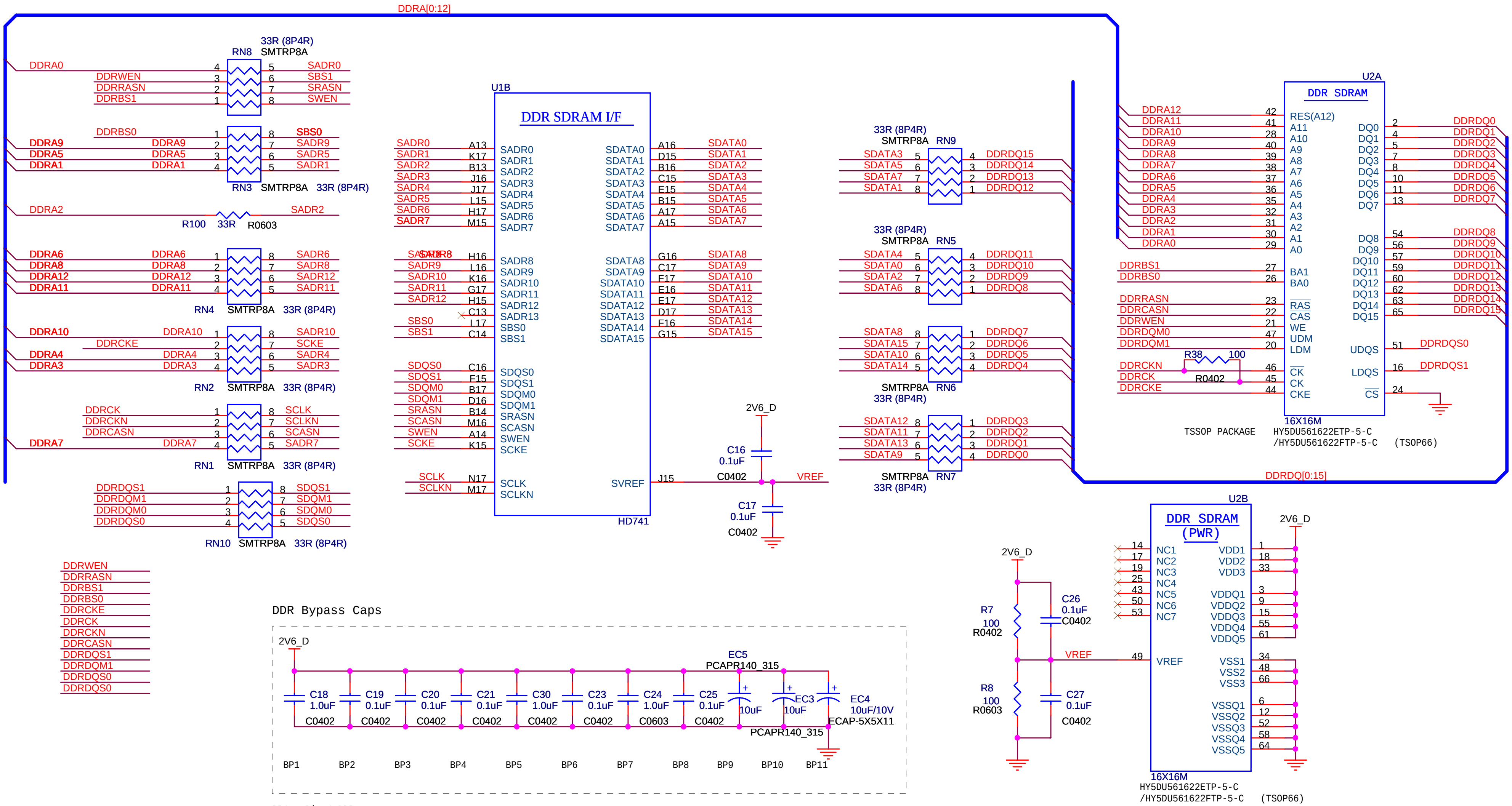
SHENZHEN MTC MULTIMEDIA CO.,LTD



Super I/O

DESIGN:	MODEL: AT2016(ZR39741)	TITLE: Super I/O
CHECKED:	PART NO.:	DWG NO: AT2016-YL01-01(A)
APPRD:	SHEET: 5 OF 11	VER: A

SHENZHEN MTC MULTIMEDIA CO.,LTD



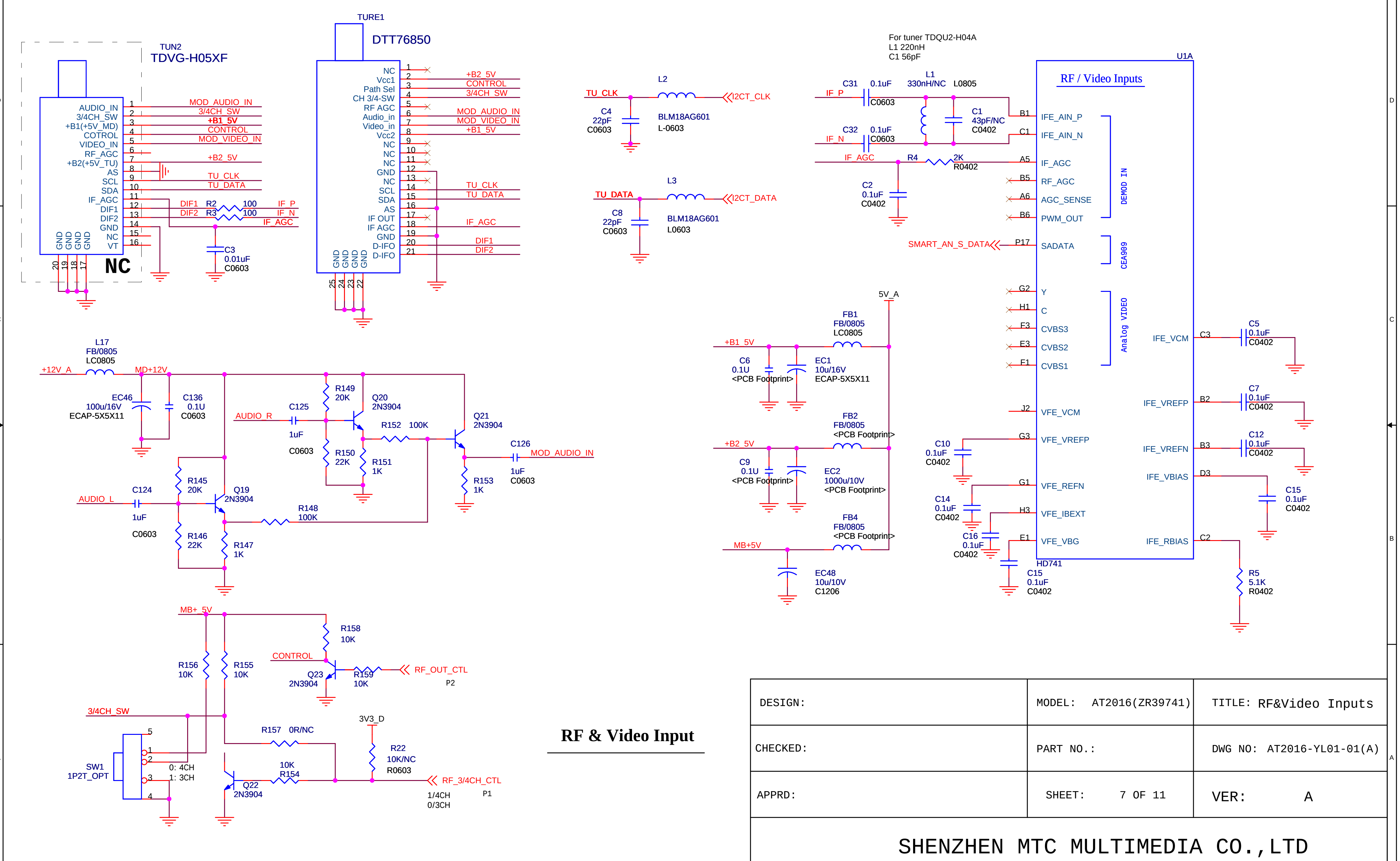
BP1 = Pin 1 DDR
BP2 = Pin 3 DDR
BP3 = Pin 61 DDR
BP4 = Pin 9 DDR
BP5 = Pin 55 DDR
BP6 = Pin 15 DDR
BP7 = Pin 33 DDR
BP8 = Pin 18 DDR
BP9 = Pin 61 DDR
BP10 = Pin 9 DDR

BP11 = Pin 33 DDR

DDR

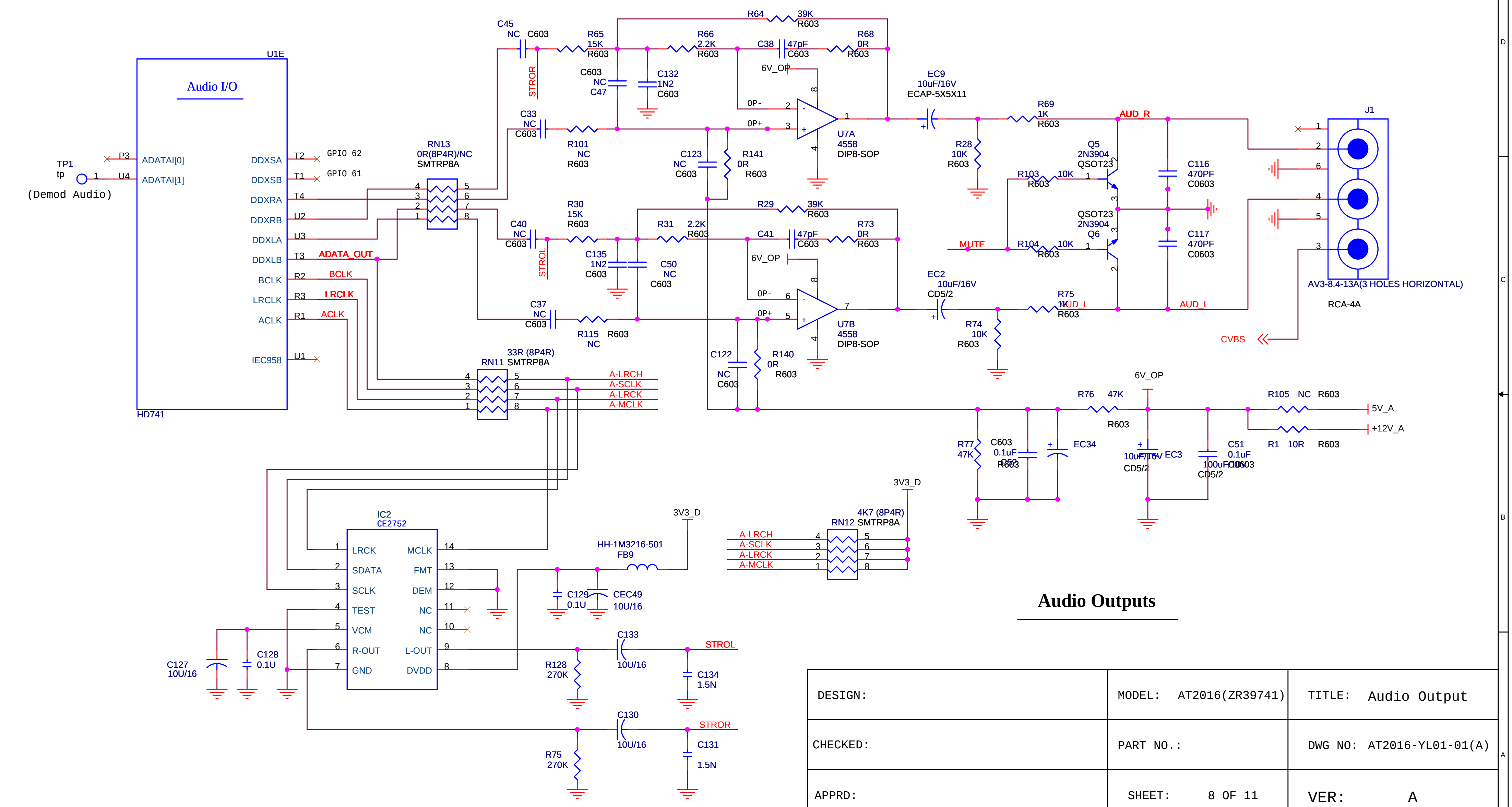
DESIGN:	MODEL: AT2016(ZR39741)	TITLE: DDR
CHECKED:	PART NO.:	DWG NO: AT2016-YL01-01(A)
APPRD:	SHEET: 6 OF 11	VER: A

SHENZHEN MTC MULTIMEDIA CO.,LTD



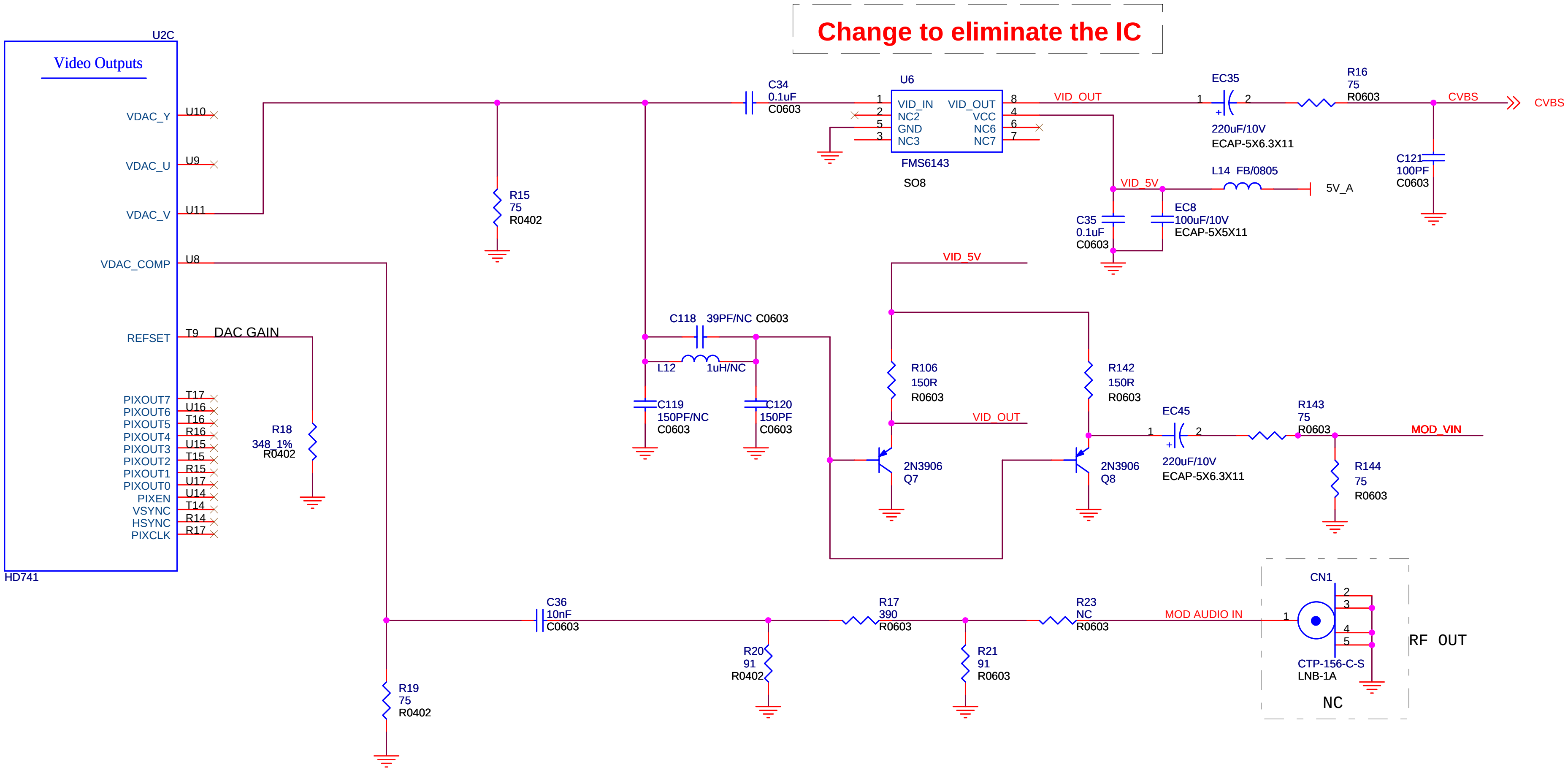
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SHENZHEN MTC MULTIMEDIA CO.,LTD



DESIGN:	MODEL: AT2016(ZR39741)	TITLE: Audio Output
CHECKED:	PART NO.:	DWG NO: AT2016-YL01-01(A)
APPRD:	SHEET: 8 OF 11	VER: A

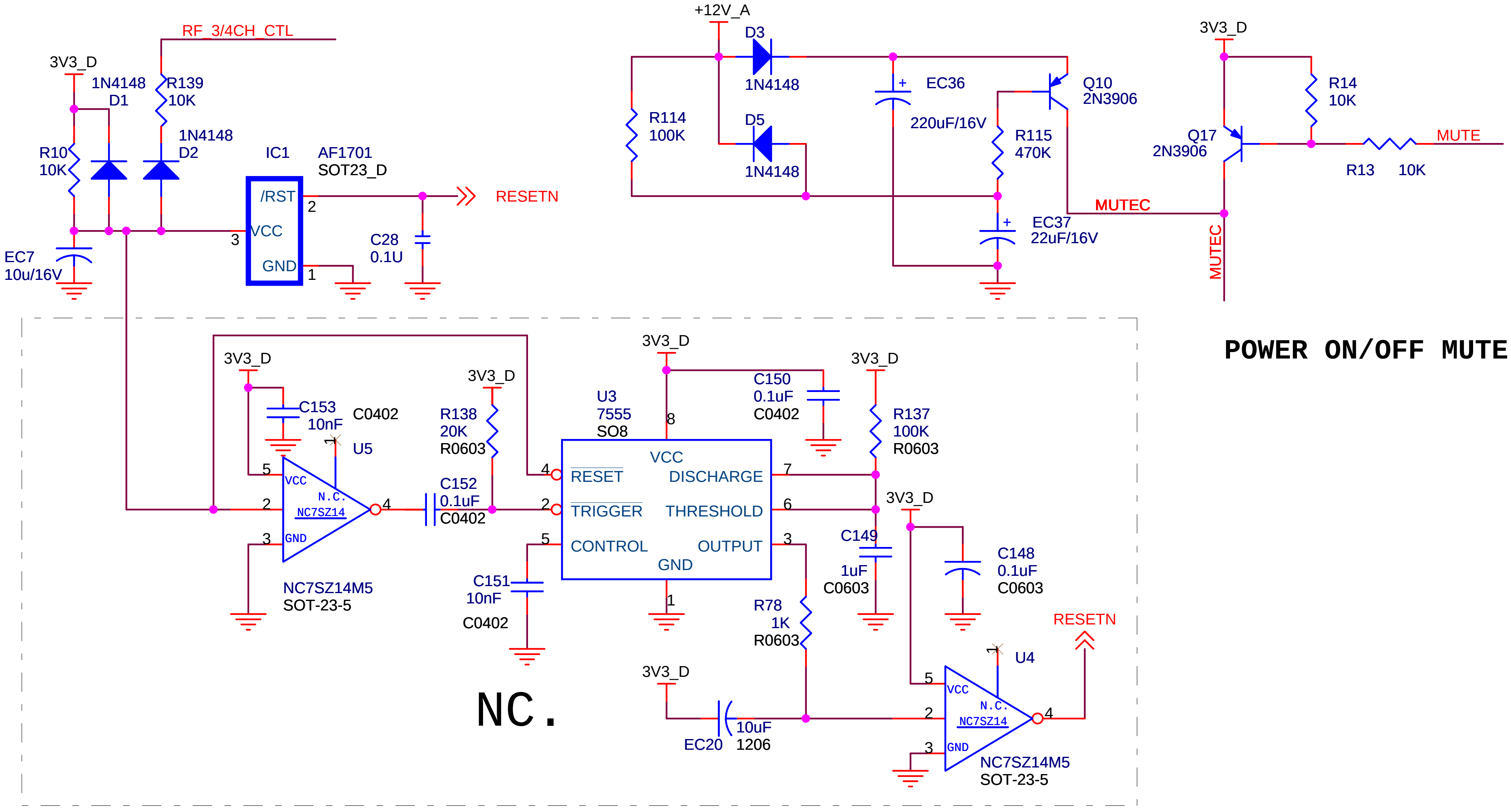
SHENZHEN MTC MULTIMEDIA CO.,LTD



Video Output

DESIGN:	MODEL: AT2016(ZR39741)	TITLE: Video Output
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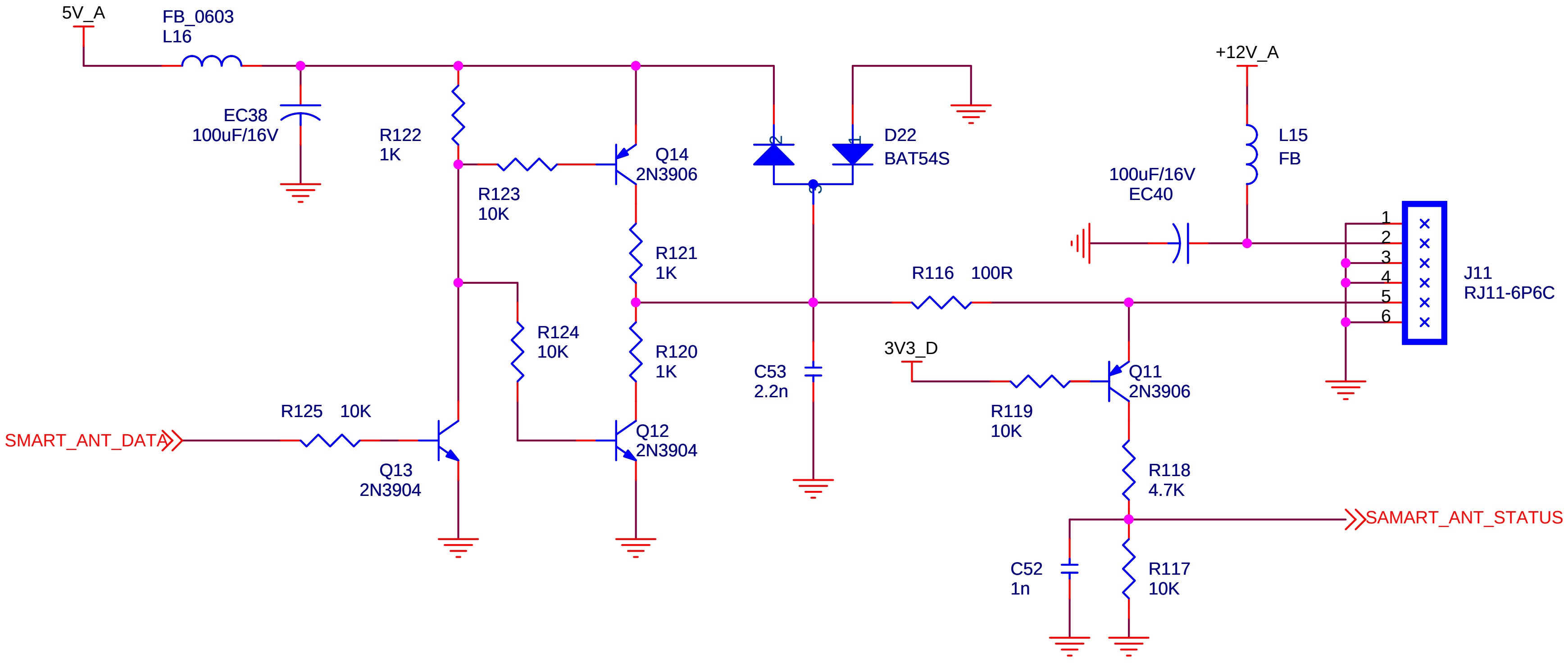
SHENZHEN MTC MULTIMEDIA CO.,LTD



Reset & MUTE

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APPRD:	SHEET: 10 OF 11	VER: A

SHENZHEN MTC MULTIMEDIA CO.,LTD

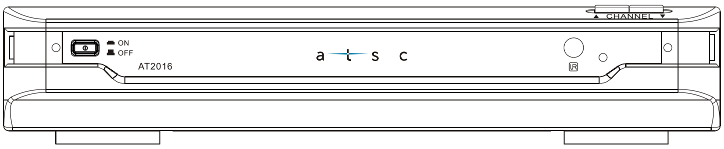


- SMART ANTENNA I/F

DESIGN:	MODEL: AT2016(ZR39741)	TITLE: SMART ANTENNA
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APPRD:	SHEET: 11 OF 11	VER: A

SHENZHEN MTC MULTIMEDIA CO.,LTD

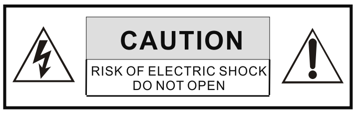
USER MANUAL
ATSC CONVERTER BOX



AT2016

Please read this User Manual carefully to ensure proper use of this product and keep this manual for future reference.

Table of Contents





THE LIGHTNING FLASH WITH ARROWHEAD SYMBOL WITHIN AN EQUILATERAL TRIANGLE IS INTENDED TO ALERT THE USER TO THE PRESENCE OF UNINSULATED "DANGEROUS VOLTAGE" WITHIN THE UNIT'S CABINET THAT MAY BE OF SUFFICIENT MAGNITUDE TO CONSTITUTE A RISK OF ELECTRIC SHOCK TO PERSONS.



THE EXCLAMATION POINT WITHIN AN EQUILATERAL TRIANGLE IS INTENDED TO ALERT THE USER TO THE PRESENCE OF IMPORTANT OPERATING AND MAINTENANCE (SERVICING) INSTRUCTIONS IN THE MANUAL ACCOMPANYING THE UNIT.

WARNING:

TO PREVENT FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THE UNIT TO RAIN OR MOISTURE. NEVER ATTEMPT TO OPEN THE CABINET, DANGEROUS HIGH VOLTAGES ARE PRESENTED IN THE UNIT. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

CAUTION:

TO PREVENT ELECTRIC SHOCK, MATCH WIDE- BLADE PLUG WITH WIDE SLOT AND FULLY INSERT.
THE APPARATUS SHALL NOT BE EXPOSED TO WATER AND NO OBJECTS FILLED WITH LIQUID SUCH AS VASES SHALL BE PLACED ON THE APPARATUS.



This symbol indicates that this product incorporates double insulation between hazardous mains voltage and user accessible parts. When servicing use only identical replacement parts.
WARNING: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or cords.

CAUTION:

THE UNIT EMPLOYS A LASER SYSTEM. TO ENSURE THE PROPER USE OF THE UNIT, READ THIS MANUAL CAREFULLY AND KEEP IT FOR FUTURE REFERENCE.

IF THE UNIT REQUIRES SERVICING, CONTACT THE SELLER OR SEE "TROUBLESHOOTING".

TO PREVENT DIRECT EXPOSURE TO THE LASER RADIATION, DO NOT OPEN THE CABINET. VISIBLE LASER MAY RADIATE WHEN THE CABINET IS OPENED OR THE INTERLOCKS ARE DEFEATED. DO NOT STARE INTO THE LASER BEAMS.

CAUTION:

THE DVD VIDEO PLAYER IS A CLASS 1 LASER PRODUCT. USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.
AS THE LASER BEAM USED IN THIS DVD VIDEO PLAYER IS HARMFUL TO THE EYES, DO NOT ATTEMPT TO DISASSEMBLE THE CABINET.
REFER SERVICING TO QUALIFIED PERSONNEL ONLY.

WARNING:

FCC REGULATIONS STATE THAT ANY CHANGE OR MODIFICATION TO THE EQUIPMENT, NOT EXPRESSLY APPROVED BY MAKER OR ITS AUTHORIZED PARTIES, COULD VOID USER'S AUTHORITY TO OPERATE THIS EQUIPMENT.

1. The apparatus shall not be exposed to dripping or Splashing and that no objects filled with liquids, such as Vases, shall be placed the apparatus.

2. The mains plug is used as the disconnect device, the disconnect device shall remain readily operable.

3. To be completely disconnect the power input, the mains plug of apparatus shall be disconnected from the mains.

4. The mains plug of apparatus should not be obstructed or should be easily accessed during intended use.

5. The battery (battery or batteries or battery pack) shall not be exposed to excessive heat such as sunshine, fire or the like.

1. Read these Instructions.

2. Keep these Instructions.

3. Heed all Warnings.

4. Follow all instructions.

5. Do not use this apparatus near water.

6. Clean only with dry cloth.

7. Do not block any of the ventilation openings. Install in accordance with the manufacturers instructions.

8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.

9. Do not defeat the safety purpose of the polarized or grounding - type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. When the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.

10. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.

11. Only use attachments/accessories specified by the manufacturer.

12. Use only with a cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.



Portable Cart Warning

13. Unplug this apparatus during lightning storms or when unused for long periods of time.

14. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

Note:
1. Important safety instructions shall be provide will each appliance.
These safety instructions may be in the form of a separate booklet, separate sheet, or part of the instruction manual.
2. If included in the instruction manual, the safety instructions shall be located before any operating instructions. 3. These instructions shall be entitled "IMPORTANT SAFETY INSTRUCTIONS' .
4. The safety instructions shall include, as applicable to the particular apparatus, the information and warnings listed before. The wording is capable of being supplements, although not replaced, by drawing or cartoons.
5. The symbol shall be shown adjacent to the text of Important Safety Instructions

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the users authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.
If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna,
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio TV technician for help.

Introduction

Thank you for purchasing this product which has been designed and manufactured to give you many years of service.

About This User Guide
This user guide contains all the information you need to know about how to setup and watch available digital TV channels using this ATSC Converter Box.

What's ATSC?
Advanced Television system committee, an international organization establishing broadcasting standards for digital (including high-defimtion and data broadcasting) television.

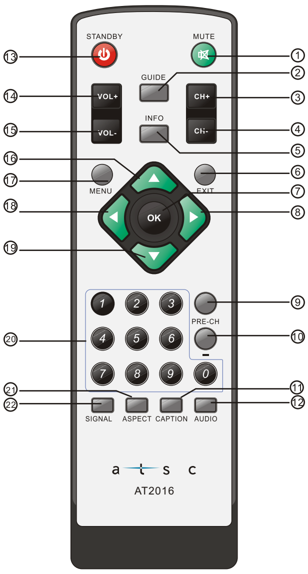
What's Digital Television?
Digital television (DTV) is a new way of transmitting high quality video and audio to your TV set. Using DTV, broadcasters can transmit high definition TV (HDTV) images, Dolby digital surround audio, and new services such as multiplexing (transmitting more than one program on the same TV channel) and datacasting (providing electronic program guides and interactive television). Several of these services can be combined into a single digital broadcast.

How to View Digital Television?
DTV is broadcast from transmitters and received via a rooftop aerial. It works like traditional TV, but because the signals are Digital you need an Atsc Converter Box to convert them. There are three ways to watch DTV: an external DTV Atsc Converter Box receiver to a DTV-ready television or an integrated digital TV with a built-in digital television tuner or personal computer (PC) tuner cards and computer monitors. An Atsc Converter Box receiver is the most popular case.



Look out for this symbol. It indicates useful and important tips

1.1 Remote Control

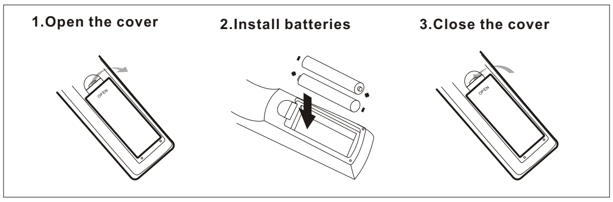


Remote Key Function:

1. MUTE: Press to mute orunmute the audio output.
2. GUIDE: Press to display theon-screen Electronic Program Guide (EPG).
3. CH+: Press to change thechannels in non-menu state.
4. CH-: Press to change thechannels in non-menu state.
5. INFO: Press to display informationabout the channel being viewed.
6. EXIT: Press to completely exitfrom the on-screen menus.
7. OK: While using the on-screenmenus, press ENTER to activate (or change) aparticular item.
8. ▶ : Press to move aroundthe menu screens
9. PRE-CH: Press to return tothe previous channel youviewed.
10. - : Press to input dashto select a channel,for example 14-1.
11. CAPTION: When a digital signal is received, Service1, Service2,... or Service6 canbe selected. When ananalog signal is received, CC1,CC2, CC3, or CC4can be selected.
12. AUDIO: Press to select theavailable multi-tracks. (Depending on the particularbroadcast, one or more foreign language translations mightbe available.)
13. STANDBY: Press to switch the Atsc Converter Boxto on and off.
14. VOL+: Press to increase theoutput volume level.
15. VOL-: Press to decrease theoutput volume level.
16. ▲: Press to move aroundthe menu screens
17. MENU: Press to display themain menu or toswitch back to the previousmenu screen that wasdisplayed.
18. ◀ : Press to move aroundthe menu screens
19. ▼ : Press to move aroundthe menu screens
20. NUMBER KEYS: Press to directly tuneto a particular channel or input digitsin menus.
21. ASPECT: Press to change thescreen format (Normal/ Zoom/Wide/Cinema) according to thescreen aspect ratio and the input signalformat.
22. SIGNAL: Press to show thesignal strength.

1.1.1 Installing the Batteries

Remove the battery cover from the remote control and put 2xAAA size batteries inside the compartment.
The diagram inside the battery compartment shows the correct way to install the batteries.



1.1.2 Using the Remote Control

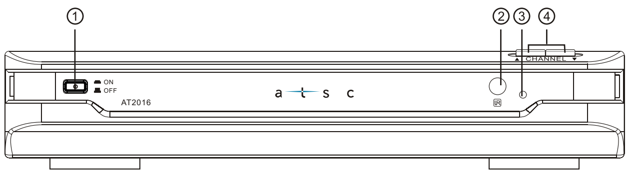
To use the remote control, point it towards the front of the digital Atsc Converter Box. The remote control has a range of up to 7 metres from the Atsc Converter Box at an angle of up to 60 degrees.
The remote control will not operate if its path is blocked.



Sunlight or very bright light will decrease the sensitivity of the remote control.

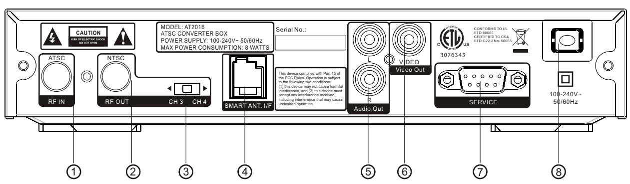
1.2 Front Panel and Rear Panel Illustration

1.2.1 Front Panel



① **POWER BUTTON:** Used to turn on or off of the main power of the unit.
② **REMOTE CONTROL SENSOR:** Used to receive the signal from the remote control.
③ **STANDBY INDICATOR:** Used to visually show power state of the Atsc Converter Box, the red LED will be light if the Atsc Converter Box entered standby mode.
④ **CHANNEL UP/DOWN:** Used to change the channels in non-menu state.

1.2.2 Rear Panel



① **RF IN :** Connect the AIR antenna or CATV cable here.(if the cable provider is passing through 8VSB signal.)
② **RF OUT:** This socket will transmit the NTSC CH3/4RF signal to your TV ANT in socket.
③ **CH3/4 SWITCH:** Select NTSC channel (Channel3:61.25MHz, Channel4:67.25MHz).
④ **SMART ANT I/F:** Connect to an external smart antenna.
⑤ **AUDIO L/R:** Connect these terminals to the analog audio inputs of a TV set (i.e., to a TV that has jacks for L/R inputs). Or connect these terminals to the L/R inputs of a separate audio component.
⑥ **Video output:** Connect this jack to the Video Input jack on your TV using an Audio/Video cable.This output port supports the only SD output..
⑦ **SERVIC :** This RS-232 PORT for software upgrade by manufacturer only and not for user.
⑧ **MAIN POWER:** Connect to main power supply using the power cord.

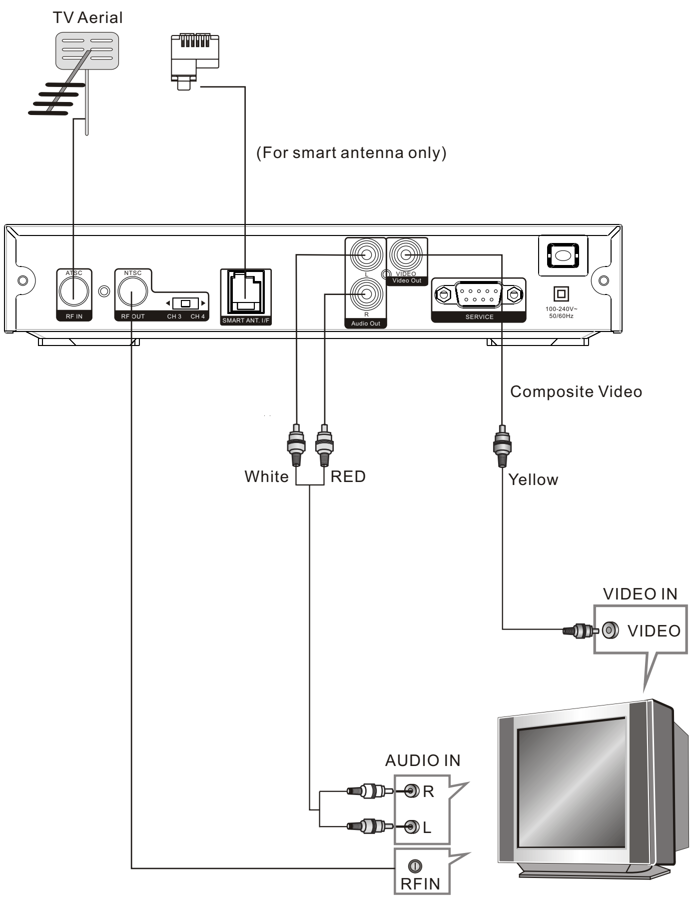
1.3 Connecting The Atsc Converter Box
The following diagrams are of typical configurations only, and may differ slightly to your existing external equipment. If you are unsure how to connect to your Atsc Converter Box, always consult your manufacturer's user manual supplied with your equipment.

1.3.1 Connecting Antennas

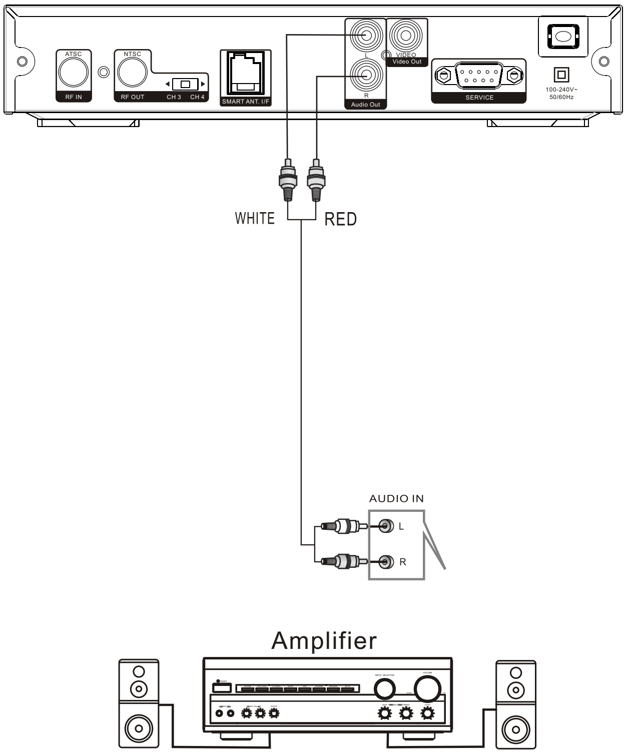
This section tells how to connect an indoor or outdoor antenna to your Atsc Converter Box. You may need a 75~ adaptor or a combiner.

NOTES:
A. If your antenna has separate leads for VHF/UHF signals, you will need to purchase a combiner to combine it before connect to the receiver.
B. The Atsc Converter Box can receive DTV signals in the event that a local cable provider is passing 8VSB through on their system. (8VSB is the RF modulation format utilized by the DTV(ATSC) digital television standard to transmit digital bits over the airwaves to the home consumer.)
C. When Receiving Digital Cable Signal : If your cable service signal does not comply with the ATSC requirement, this product may not operate properly.

1.3.2 Connecting to a TV Set



1.3.3 Connecting to an Audio System



2. On-Screen Menus

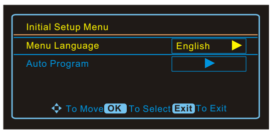
Ensure all connections have been made following the diagrams on the previous pages for reference.

When you plug the power cord of this set-top box into a power outlet and press the **POWER** switch on the front panel, the box will be turn on for the first time.

Press **STANDBY** button on the remote control will switch the set-top box to or from standby mode.

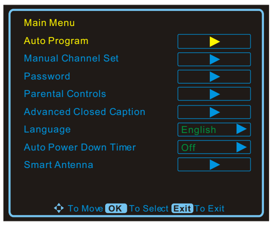
Turn on the TV set and switch it to external AV mode, you will see the picture come from the box.

If it is the first time you use this device, an Auto Program menu appears to let you to scan all the available channels in your area.



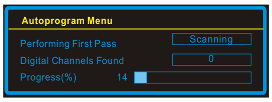
Main Menu

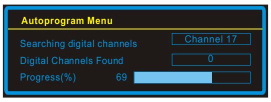
Press the **MENU** button on the remote control, the main menu will display as below. the **Auto Program** focus is highlighted as default.



2.1 Auto Program

If it's the first time you use the box, you should scan all the TV channels first, press the arrow buttons to move the cursor to **Auto Program** in main menu, press the **OK** button to confirm, you will see below menu which indicates auto search is in process. After all channels in your area are found, you will see the first found channel showing on the screen. Any time if you want to start auto channel search again, you can follow the above procedure.





2.2 Manual Channel Set
You can highlight this item and press **OK** button to confirm it, you will see below menu showing on screen. You can specific the selected channel "Viewable" or "Not viewable", the not viewable channels will be skipped when you do zapping next time.



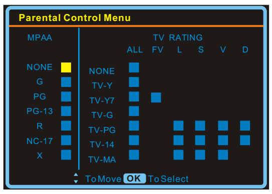
2.3 Password
When this item is highlighted, press the **OK** button will enter the **Enter Old Password** menu as below.



When you entered the correct password(the default password is 6666), the **Enter New Password** and **Confirm New Password** will pop up sequentially, if the new input passwords verified successfully, the **Password Changed** message will pop up in the right up corner.

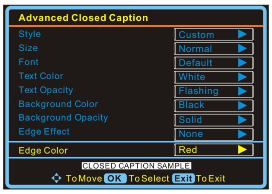
2.4 Parental Control
When this item is highlighted, press the **OK** button will enter the **Enter Password** menu, you will enter the **Parental Control Menu** as below if the password you entered is correct. This device support 2 rating systems used in the United States:
1),**The Motion Picture Association of America's (MPAA)** ratings include the following ratings: **G**(General Audiences-All Ages Admitted)**, PG**(Parental Guidance Suggested. Some Material May Not Be Suitable For Children)**, PG-13**(Parents Strongly Cautioned. Some Material Maybe Inappropriate For Children Under 13), **R**(Restricted, Under 17 Requires Accompanying Parent Or Adult Guardian),**NC-17** (No One 17 And Under Admitted).

2),The **TV Rating system** include the following ratings: **TV-Y**(all children) and **TV-Y7**(directed to older children),**TV-G** (general audience), **TV-PG**(parental guidance suggested), **TV-14**(parents strongly cautioned), and **TV-MA**(mature audiences only). The letters **FV**(Fantasy Violence),**V**(moderate Violence), **S** (mild Sexual situations), **L**(mild coarse Language), **D**(mature themes suggestive Dialogue) were added to indicate the presence of violence, sex, language, suggestive dialogue respectively.



2.5 Advanced Closed Caption

When this item is highlighted, press the **OK** button will enter the **Advanced Closed Caption** menu as below.



If you choose the **Style** as **Automatic**, the caption **Size/Font/Text Color/Text Opacity/Background Color/Background Opacity/Edge Effect/Edge Color** will be set to Automatic also, and you will see help information **DECIDED BY BROAD CASTING** at the bottom of the menu.

If you choose the Style as **Custom**, you will see help information **CLOSED CAPTION SAMPLE** at the bottom of the menu, you can change all above caption related parameters separately as you want.

2.6 Language

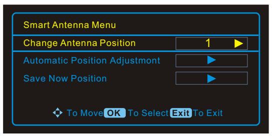
When this item is highlighted, you can press **OK** button to change the OSD menu language as you want, there are 3 options: **English, Spanish, French.**

2.7 Auto Power Down Timer

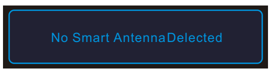
When this item is highlighted, press the **OK** button you can choose the options: **Off, 2 hours, 4 hours.** the receiver will enter standby mode according to the specific setting if the latter 2 options chose.

2.8 Smart Antenna

When this item is highlighted, press the **OK** button you can enter the below menu if a smart antenna is presented at the rear panel of your box,



If the smart antenna not presented you can not enter above menu, you will see below **No Smart Antenna Detected** message.



3. Troubleshooting

Q: It takes a while to display picture on the screen after turning power on or after changing channel.
A: It will take several seconds for this receiver to show the logo or picture after power on sincee the system have to finished the initialization of the main chip and demodulator. In case of digital broadcasting, it could take 1 to 2 seconds to receive data. Therefore, it is not a faulty receiver if the picture display is delayed.

Q: There is no picture on the screen.
A: Make sure the power is on.
Make sure the cable between the receiver and the TV is connected properly.
Make sure the TV's external video input mode is selected correctly.
Make sure the video output is selected correctly.
Make sure the antenna is positioned correctly.
Try turning the receiver off and then back on again.

Q: Poor video quality or screen flickering.
A. This is a result of a poor broadcast signal.
Rotate the antenna to a different direction.

Q: No Sound.
A: Make sure the cable between the receiver and the TV audio jack or your audio system is connected properly.
Try pressing the MUTE button on the remote.
Try pressing the VOL+ button on the remote continuously.
Try turning the receiver off and then back on again.

Q: The remote control does not work.
A: Make sure there is no obstruction between the remote controller and the remote sensor of the receiver.
Make sure the distance and degree is not out of range.
Check to insure the batteries are installed correctly.
Install a pair of new batteries.

4. Specification

Product Name
ATSC Converter Box Receiver

Power Supply
Input Voltage: 100 - 240V~ 50/60Hz
Power Consumption: Maximum 8W, Standby <1W.

Decoder
Video Format: Standard definition CVBS.
Audio Format: Dolby Digital audio

R F **Signal Input/Output**
ATSC Antenna/Cable RF In: F-Connector
NTSC Ch3/4 RF out: F-Connector
Antenna Impedance: 75 Ohms
Channels: VHF 2 -13 , UHF 14 - 69
Smart Antenna interface

Video Outputs
Composite Video Output for standard analog sets: RCA Connector

Audio Outputs
Analog Audio Outputs (L/R): RCA Connectors

Service
Software upgrade through RS-232 port: 9 pin D-Sub type

Remote Control format
NEC protocol (38KHz carrier pulse width modulation).





5. Glossary

ATSC:
"Advanced Television Systems Committee." Formed to establish technical standards for U.S. advanced television systems. Also, the name given to the 8-VSB transmission standard itself.

NTSC:
"National Television Systems Committee" and the name of the current analog transmission standard used in the U.S., which the committee created in 1953.

Analog TV:
Analog technology has been in use for the past 50 years to transmit conventional TV signals to consumers. "Standard" television broadcasts in analog TV. Analog signals vary continuously, creating fluctuations in color, brightness and quality.

Digital Television (DTV):
Digital TV is the umbrella term encompassing High-definition Television and several other applications, including Standard Definition Television.

SDTV:
"Standard Definition Television." Digital formats that do not achieve the video quality of HDTV, but are at least equal, or superior to, NTSC pictures. SDTV may have either 4:3 or 16:9 aspect ratios, and it includes surround sound. Variations of fps (frames per second), lines of resolution, and other factors of 480p and 480i make up the 12 SDTV formats in the ATSC standard.

HDTV:
"High-definition Television." This is the most superior video picture available in Digital TV. In the U.S., the 1080i and 720p formats in a 16:9 aspect ratio are the two acceptable HDTV formats. HDTV is a component of DTV.

Dolby Digital:
This is a digital surround sound technology used in movie theaters and upscale home theater systems that enhances audio. Home theater components with this technology work in conjunction with a "5.1-speaker" system (five speakers plus a low-frequency subwoofer) to produce true-to-life audio that draws the listener into the onscreen action. Six discreet audio channels are used: Left, Center, Right, Left Rear (or side), Right Rear (or side), and a subwoofer -- LFE, "low frequency effects" -- (considered the ". 1 " as it is limited in bandwidth).

Smart Antenna:
A smart antenna system combines multiple antenna elements with a signal-processing capability to optimize its radiation and/or reception pattern automatically in response to the signal environment.

atsc